



RSA/Rule: RSA 482-A/ Env-Wt 100-900

**WETLANDS PERMIT APPLICATION**

Land Resources Management

Wetlands Bureau

Check the status of your application: [www.des.nh.gov/onestop](http://www.des.nh.gov/onestop)

Administrative Use Only	Administrative Use Only	Administrative Use Only	File No.:
			Check No.:
			Amount:
			Initials:

**1. REVIEW TIME:**

Indicate your Review Time below. Refer to Guidance Document A for instructions.

☒ Standard Review (Minimum, Minor or Major Impact)☐ Expedited Review (Minimum Impact only)**2. PROJECT LOCATION:**

Separate applications must be filed with each municipality that jurisdictional impacts will occur in.

ADDRESS: **NH Route 63**TOWN/CITY: **Westmoreland**

TAX MAP:

BLOCK:

LOT:

UNIT:

USGS TOPO MAP WATERBODY NAME: **Mill Brook**☐ NASTREAM WATERSHED SIZE: **5.2 sq. mi.**☐ NALOCATION COORDINATES (If known): **42.99167, -72.44546**☒ Latitude/Longitude ☐ UTM ☐ State Plane**3. PROJECT DESCRIPTION:**

Provide a brief description of the project outlining the scope of work. Attach additional sheets as needed to provide a detailed explanation of your project. DO NOT reply "See Attached" in the space provided below.

**Preservation response to stabilize bridge from scour. The proposed work entails bank stabilization (replacing rip rap along the slopes where it has been previously scoured away) along the banks of Mill Brook to protect the bridge (109/124) that carries NH Route 63 over the Brook. The proposed work also includes installation of bendway weirs to halt bank erosion.**

**4. SHORELINE FRONTAGE**☒ NA This lot has no shoreline frontage.

SHORELINE FRONTAGE:

Shoreline frontage is calculated by determining the average of the distances of the actual natural navigable shoreline frontage and a straight line drawn between the property lines, both of which are measured at the normal high water line.

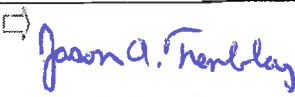
**5. RELATED PERMITS, ENFORCEMENT, EMERGENCY AUTHORIZATION, SHORELAND, ALTERATION OF TERRAIN, ETC...****6. NATURAL HERITAGE BUREAU & DESIGNATED RIVERS:**

See the Instructions &amp; Required Attachments document for instructions to complete a &amp; b below.

a. Natural Heritage Bureau File ID: NHB **16** - **3592**.b. ☐ Designated River the project is in  $\frac{1}{4}$  miles of: \_\_\_\_\_; anddate a copy of the application was sent to the Local River Management Advisory Committee: Month: \_\_\_\_ Day: \_\_\_\_ Year: \_\_\_\_☒ NA[shoreland@des.nh.gov](mailto:shoreland@des.nh.gov) or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

[www.des.nh.gov](http://www.des.nh.gov)

<b>7. APPLICANT INFORMATION (Desired permit holder)</b>			
LAST NAME, FIRST NAME, M.I.: <b>NHDOT</b>			
TRUST / COMPANY NAME:		MAILING ADDRESS: <b>7 Hazen Drive</b>	
TOWN/CITY: <b>Concord</b>		STATE: <b>NH</b>	ZIP CODE: <b>03301</b>
EMAIL or FAX: <b>Jason.Tremblay@dot.nh.gov</b>		PHONE: <b>603-271-2731</b>	
ELECTRONIC COMMUNICATION: By initialing here: <u>JAT</u> , I hereby authorize NHDES to communicate all matters relative to this application electronically			
<b>8. PROPERTY OWNER INFORMATION (If different than applicant)</b>			
LAST NAME, FIRST NAME, M.I.:			
TRUST / COMPANY NAME:		MAILING ADDRESS:	
TOWN/CITY:		STATE:	ZIP CODE:
EMAIL or FAX:		PHONE:	
ELECTRONIC COMMUNICATION: By initialing here _____, I hereby authorize NHDES to communicate all matters relative to this application electronically			
<b>9. AUTHORIZED AGENT INFORMATION</b>			
LAST NAME, FIRST NAME, M.I.:		COMPANY NAME:	
MAILING ADDRESS:			
TOWN/CITY:		STATE:	ZIP CODE:
EMAIL or FAX:		PHONE:	
ELECTRONIC COMMUNICATION: By initialing here _____, I hereby authorize NHDES to communicate all matters relative to this application electronically			
<b>10. PROPERTY OWNER SIGNATURE:</b>			
See the Instructions & Required Attachments document for clarification of the below statements			
By signing the application, I am certifying that:			
<ol style="list-style-type: none"> <li>1. I authorize the applicant and/or agent indicated on this form to act in my behalf in the processing of this application, and to furnish upon request, supplemental information in support of this permit application.</li> <li>2. I have reviewed and submitted information &amp; attachments outlined in the Instructions and Required Attachment document.</li> <li>3. All abutters have been identified in accordance with RSA 482-A:3, I and Env-Wt 100-900.</li> <li>4. I have read and provided the required information outlined in Env-Wt 302.04 for the applicable project type.</li> <li>5. I have read and understand Env-Wt 302.03 and have chosen the least impacting alternative.</li> <li>6. Any structure that I am proposing to repair/replace was either previously permitted by the Wetlands Bureau or would be considered grandfathered per Env-Wt 101.47.</li> <li>7. I have submitted a Request for Project Review (RPR) Form (<a href="http://www.nh.gov/nhdhr/review">www.nh.gov/nhdhr/review</a>) to the NH State Historic Preservation Officer (SHPO) at the NH Division of Historical Resources to identify the presence of historical/ archeological resources while coordinating with the lead federal agency for NHPA 106 compliance.</li> <li>8. I authorize NHDES and the municipal conservation commission to inspect the site of the proposed project.</li> <li>9. I have reviewed the information being submitted and that to the best of my knowledge the information is true and accurate.</li> <li>10. I understand that the willful submission of falsified or misrepresented information to the New Hampshire Department of Environmental Services is a criminal act, which may result in legal action.</li> <li>11. I am aware that the work I am proposing may require additional state, local or federal permits which I am responsible for obtaining.</li> </ol>			
 Property Owner Signature		Jason A. Tremblay Print name legibly	07/13/17 Date

## MUNICIPAL SIGNATURES

### 11. CONSERVATION COMMISSION SIGNATURE

The signature below certifies that the municipal conservation commission has reviewed this application, and:

1. Waives its right to intervene per RSA 482-A:11;
2. Believes that the application and submitted plans accurately represent the proposed project; and
3. Has no objection to permitting the proposed work.



Conservation Commission Signature

Print name legibly

Date

#### DIRECTIONS FOR CONSERVATION COMMISSION

1. Expedited review ONLY requires that the conservation commission's signature is obtained in the space above.
2. Expedited review requires the Conservation Commission signature be obtained **prior** to the submittal of the original application to the Town/City Clerk for signature.
3. The Conservation Commission may refuse to sign. If the Conservation Commission does not sign this statement for any reason, the application is not eligible for expedited review and the application will be reviewed in the standard review time frame.

### 12. TOWN / CITY CLERK SIGNATURE

As required by Chapter 482-A:3 (amended 2014), I hereby certify that the applicant has filed four application forms, four detailed plans, and four USGS location maps with the town/city indicated below.



Town/City Clerk Signature

Print name legibly

Town/City

Date

#### DIRECTIONS FOR TOWN/CITY CLERK:

1. For applications where "Expedited Review" is checked on page 1, if the Conservation Commission signature is not present, NHDES will accept the permit application, but it will NOT receive the expedited review time.
2. IMMEDIATELY sign the original application form and four copies in the signature space provided above;
3. Return the signed original application form and attachments to the applicant so that the applicant may submit the application form and attachments to NHDES by mail or hand delivery.
4. IMMEDIATELY distribute a copy of the application with one complete set of attachments to each of the following bodies: the municipal Conservation Commission, the local governing body (Board of Selectmen or Town/City Council), and the Planning Board; and
5. Retain one copy of the application form and one complete set of attachments and make them reasonably accessible for public review.

#### DIRECTIONS FOR APPLICANT:

1. Submit the single, original permit application form bearing the signature of the Town/ City Clerk, all additional materials, and the application fee to NHDES by mail or hand delivery.

**13. IMPACT AREA:**

For each jurisdictional area that will be/has been impacted, provide square feet and, if applicable, linear feet of impact

Permanent: impacts that will remain after the project is complete.

Temporary: impacts not intended to remain (and will be restored to pre-construction conditions) after the project is complete.

JURISDICTIONAL AREA	PERMANENT Sq. Ft. / Lin. Ft.	TEMPORARY Sq. Ft. / Lin. Ft.
Forested wetland	442 <input type="checkbox"/> ATF	5967 <input type="checkbox"/> ATF
Scrub-shrub wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Emergent wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Wet meadow	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Intermittent stream	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Perennial Stream / River	1245 / 84 <input type="checkbox"/> ATF	5931 / 206 <input type="checkbox"/> ATF
Lake / Pond	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Bank - Intermittent stream	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Bank - Perennial stream / River	443 / 76 <input type="checkbox"/> ATF	691 / 166 <input type="checkbox"/> ATF
Bank - Lake / Pond	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Tidal water	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Salt marsh	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Sand dune	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Prime wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Prime wetland buffer	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Undeveloped Tidal Buffer Zone (TBZ)	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Previously-developed upland in TBZ	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - Lake / Pond	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - River	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - Tidal Water	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
<b>TOTAL</b>	<b>2130 / 160</b>	<b>12589 / 372</b>

**14. APPLICATION FEE:** See the Instructions & Required Attachments document for further instruction

☐ Minimum Impact Fee: Flat fee of \$ 200

☒ Minor or Major Impact Fee: Calculate using the below table below

Permanent and Temporary (non-docking) 14719 sq. ft. X \$0.20 = \$ 2943.80

Temporary (seasonal) docking structure:                      sq. ft. X \$1.00 = \$

Permanent docking structure:                      sq. ft. X \$2.00 = \$

**Projects proposing shoreline structures (including docks) add \$200 = \$**

**Total = \$ 2943.80**

The Application Fee is the above calculated Total or \$200, whichever is greater = \$ 2943.80

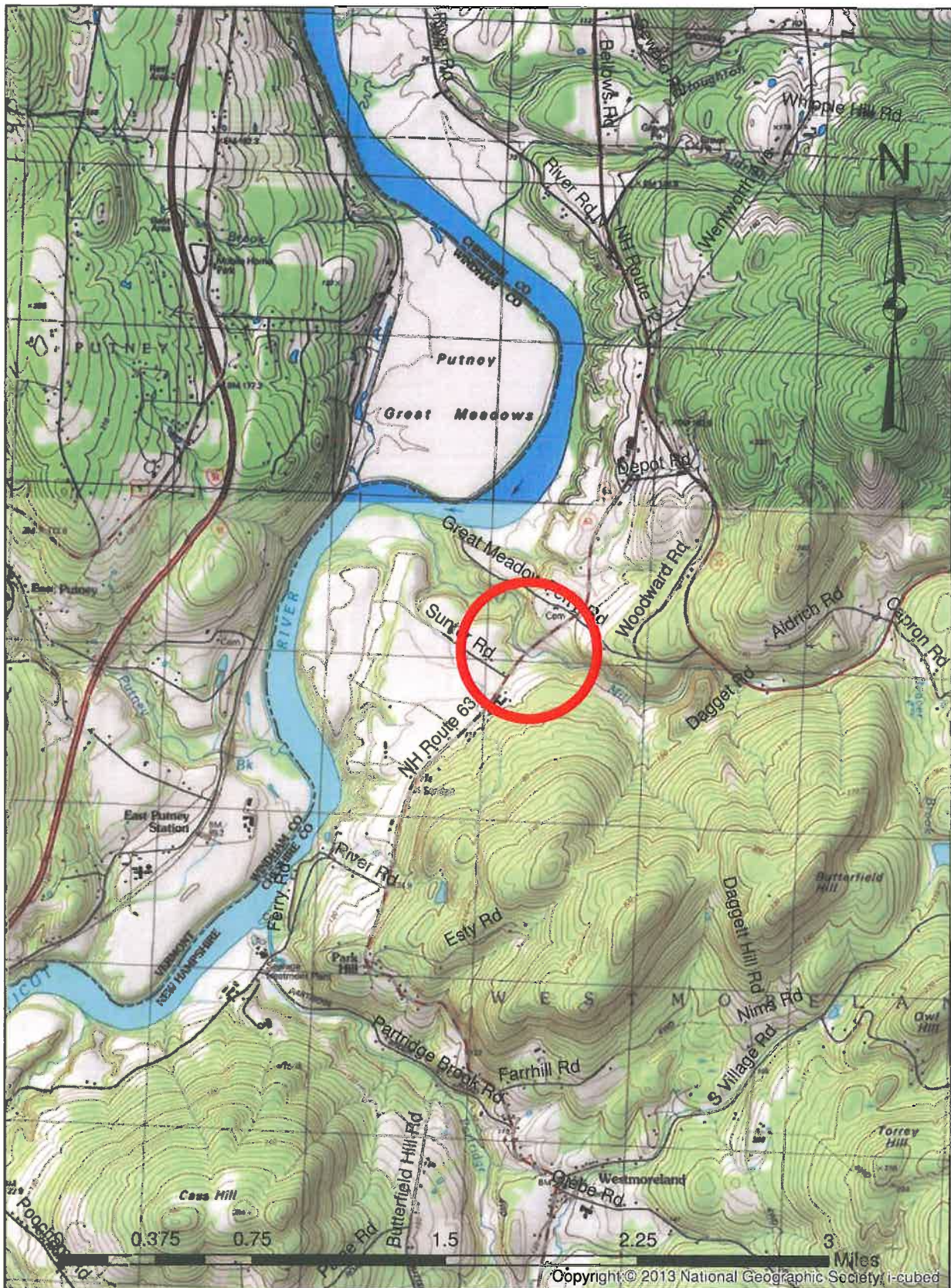
[shoreland@des.nh.gov](mailto:shoreland@des.nh.gov) or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

[www.des.nh.gov](http://www.des.nh.gov)

# Westmoreland 109/124

## Route 63 over Mill Brook



1124,000



## WETLANDS PERMIT APPLICATION – ATTACHMENT A MINOR AND MAJOR - 20 QUESTIONS

Land Resources Management  
Wetlands Bureau

Check the Status of your application: [www.des.nh.gov/onestop](http://www.des.nh.gov/onestop)



RSA/ Rule: RSA 482-A, Env-Wt 100-900

**Env-Wt 302.04 Requirements for Application Evaluation** - For any major or minor project, the applicant shall demonstrate by plan and example that the following factors have been considered in the project's design in assessing the impact of the proposed project to areas and environments under the department's jurisdiction. Respond with statements demonstrating:

**1. The need for the proposed impact.**

Scour has removed existing stone fill from bridge # 109/124 along the southeast wing and is eroding the southwest bank upstream of the bridge. Keyed rip-rap will be placed in front of the southeast wing to stop the undermining of the wing and bendway wiers will be placed along the upstream southwest bank to direct flow back towards the thalweg of the brook and stop the erosion of the bank. It is anticipated the access to these areas will be from the southeast quadrant.

**2. That the alternative proposed by the applicant is the one with the least impact to wetlands or surface waters on site.**

The alternative proposed is the one with the least impact to the wetlands and surface waters since it is replacing the existing material that has been washed away due to scour. The bendway wiers will require less stone placed in the river and banks to control the erosion than stoning the entire bank of the channel. The preferred proposed alternative meets the needs at the site to protect the existing infrastructure and extend the lifetime of this structure that is already in good condition.

3. The type and classification of the wetlands involved.

**R2UB1: Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-gravel  
BANK**

4. The relationship of the proposed wetlands to be impacted relative to nearby wetlands and surface waters.

**Mill Brook flows into the Connecticut River.**

5. The rarity of the wetland, surface water, sand dunes, or tidal buffer zone area.

**Mill Brook has not been identified as a rare surface water of the state.**

6. The surface area of the wetlands that will be impacted.

**(5,931 ft2 temporary, 1,245 ft2 permanent) Riverine  
(5,967 ft2 temporary, 442 ft2 permanent) Palustrine  
(691 ft2 temporary, 443 ft2 permanent) Bank**

7. The impact on plants, fish and wildlife including, but not limited to:
- a. Rare, special concern species;
  - b. State and federally listed threatened and endangered species;
  - c. Species at the extremities of their ranges;
  - d. Migratory fish and wildlife;
  - e. Exemplary natural communities identified by the DRED-NHB; and
  - f. Vernal pools.

**There are no rare or special concern species identified within the proposed project area.**

**According to information provided by the New Hampshire Fish and Game Department, there are not documented Northern Long-Eared Bat roost trees or hibernacula in Westmoreland. The 27287 Statewide Project qualifies for review in accordance with the FHWA, FRA, FTA Programmatic Consultation for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat. As the project meets the requirements for review under the Programmatic Consultation, the project may rely on the concurrence provided in the FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat to satisfy consultation requirements under Section 7 of the Endangered Species Act. Project activities will adhere to applicable avoidance and minimization measures. The project has been determined to be likely to adversely affect (LAA) the threatened Northern Long-Eared Bat due to proposed active season tree clearing. A bridge assessment is planned to survey the bridge for evidence of bat utilization. If any indication of bat use of the bridge is discovered, the project construction will not be initiated until completion of consultation with USFWS. A copy of the project details, the bridge assessment results, and the determination of LAA IPaC decision key results will be submitted to the USFWS Regional Office.**

**There are no species known to be at the extremities of their ranges located in Mascoma River or the surrounding area.**

**There will be no impact on migratory fish and wildlife within the proposed project area.**

**There are no exemplary natural communities identified by the DRED-NHB within the proposed project area.**

**There are no vernal pools identified within the project area.**

8. The impact of the proposed project on public commerce, navigation and recreation.

**The proposed project will not impact public commerce, navigation or recreation once completed. The scour and erosion preservation work will reestablish existing conditions of the banks and streambed.**

9. The extent to which a project interferes with the aesthetic interests of the general public. For example, where an applicant proposes the construction of a retaining wall on the bank of a lake, the applicant shall be required to indicate the type of material to be used and the effect of the construction of the wall on the view of other users of the lake.

**The project will not interfere with the aesthetic interests of the general public. The rip-rap and stone fill proposed will be on the banks and keyed into the channel which will blend in with the existing material currently at these locations and replace the stone that was previously there before being scoured away.**

10. The extent to which a project interferes with or obstructs public rights of passage or access. For example, where the applicant proposes to construct a dock in a narrow channel, the applicant shall be required to document the extent to which the dock would block or interfere with the passage through this area.

**The proposed project will not interfere with or obstruct public rights of passage or access. Once completed the scour and erosion preservation work will maintain the same previous access.**

11. The impact upon abutting owners pursuant to RSA 482-A:11, II. For example, if an applicant is proposing to rip-rap a stream, the applicant shall be required to document the effect of such work on upstream and downstream abutting properties.

**The project will not have an impact on abutting properties. The scour preservation work will reestablish the banks and channel to existing conditions. The proposed project will not alter the risk of flooding on abutting properties. There will be no change in flood storage. Access will remain as it exists currently once the project is complete.**

12. The benefit of a project to the health, safety, and well being of the general public.

**The project will protect the bridge from being undermined due to scour. This will allow the bridge to remain open to benefit commerce, trade, emergency access, etc, for the general public.**

13. The impact of a proposed project on quantity or quality of surface and groundwater. For example, where an applicant proposes to fill wetlands the applicant shall be required to document the impact of the proposed fill on the amount of drainage entering the site versus the amount of drainage exiting the site and the difference in the quality of water entering and exiting the site.

The proposed project will not significantly alter the existing surface water runoff or storm water discharge locations. Best Management Practices will be used to prevent any adverse effect to water quality during construction. The total area of impervious surface within the project limits will remain the same and the bank slopes will not be altered either. Stormwater runoff will continue to flow off the roadway and embankments the same way as prior to the scour protection work.

14. The potential of a proposed project to cause or increase flooding, erosion, or sedimentation.

**Flooding:** The scour protection will not increase the potential for flooding. The proposed structure is able to pass the 100 year storm event.

**Erosion:** The riprap will prevent further erosion and restore the natural alignment and gradient of the stream channel.

**Sedimentation:** Nothing that will be a barrier to sediment transport will be installed in this project. Sedimentation in the open channel will not be caused as a result of this project.

15. The extent to which a project that is located in surface waters reflects or redirects current or wave energy which might cause damage or hazards.

Surface waters will not be reflected or redirected as a result of this project. Mill Brook does not have enough surface water for wave energy to be an issue.

16. The cumulative impact that would result if all parties owning or abutting a portion of the affected wetland or wetland complex were also permitted alterations to the wetland proportional to the extent of their property rights. For example, an applicant who owns only a portion of a wetland shall document the applicant's percentage of ownership of that wetland and the percentage of that ownership that would be impacted.

The work consists of scour protection to stabilize the existing bridge and erosion protection to stabilize the slopes. There are no similar structures in the vicinity owned by other parties that would require repair.

17. The impact of the proposed project on the values and functions of the total wetland or wetland complex.

The value of the wetland as a habitat for living organisms will be unchanged. A function of Mill Brook is to carry water from a higher elevation to a lower elevation. This project will not interfere with that function.

18. The impact upon the value of the sites included in the latest published edition of the National Register of Natural Landmarks, or sites eligible for such publication.

This project is not located in or near any Natural Landmarks listed on the National Register.

19. The impact upon the value of areas named in acts of Congress or presidential proclamations as national rivers, national wilderness areas, national lakeshores, and such areas as may be established under federal, state, or municipal laws for similar and related purposes such as estuarine and marine sanctuaries.

There are no areas named in acts of congress or presidential proclamations as national rivers, national wildness areas, or national lakeshores that will be impacted as a result of this project.

20. The degree to which a project redirects water from one watershed to another.

The project as proposed will not redirect water from one watershed to another.

Additional comments



## **BUREAU OF ENVIRONMENT CONFERENCE REPORT**

**SUBJECT:** NHDOT Monthly Natural Resource Agency Coordination Meeting

**DATE OF CONFERENCE:** May 17, 2017

**LOCATION OF CONFERENCE:** John O. Morton Building

**ATTENDED BY:**

### **NHDOT**

Matt Urban  
Sarah Large  
Steve Johnson  
Mark Hemmerlein  
Jason Trembley  
Wendy Johnson  
Jim Kirouac  
Joseph Adams  
Michael Licciardi  
Jonathan Hebert

### **Federal Highway Administration**

Jamie Sikora

### **ACOE**

Rick Cristoff

### **US Coast Guard**

Jim Rousseau

### **NHDES**

Gino Infascelli  
Lori Sommer  
Eben Lewis

### **NHF&G**

Carol Henderson

### **NH Natural Heritage**

#### **Bureau**

Amy Lamb

### **Consultants/Public Participants**

Jim Murphy  
Dan Hageman  
Stephanie Dyer-Carroll  
Mike Long  
Dave Kull  
Steve Hoffmann  
Ben Martin  
John Parrelli  
Sean James  
Kimberly Peace

*(When viewing these minutes online, click on an attendee to send an e-mail)*

### **PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH:**

*(minutes on subsequent pages)*

Finalization April 19 <sup>th</sup> , 2017 Meeting Minutes .....	2
Westmoreland, #41394 (Non-federal) .....	2
Derry, #40572 (Non-federal) .....	2
Gorham, #41393 (Non-federal) .....	3
New Castle-Rye, 16127 (X-A001(146)) .....	4
Statewide, #27287 (X-A003(473)) .....	6
Nashua-Merrimack-Bedford, #13761 (IM-0931(201)) .....	8
Nashua Heritage Trail to Mine Falls Park Connection, #40429 (X-A004(400)) .....	9

*(When viewing these minutes online, click on a project to zoom to the minutes for that project)*

Mr. Hageman asked Rick Cristoff with USACE whether he thought the project could be permitted through a PGP. Mr. Cristoff said he didn't know why it couldn't be a PGP, but that he wanted to confirm with Mike Hicks.

Jim Rousseau with the USCG said that the project team will need to coordinate with the USCG office in Boston. He indicated that Witch Cove Marina has been purchased and that this will need to be addressed.

Lori Sommer with NH Department of Environmental Services (NHDES) asked whether Mike Johnson had provided feedback. Mr. Hageman said the project team coordinated with Mr. Kevin Madley of NOAA in 2014. Ms. Sommer stated that the permanent impacts would be assessed a 3 to 1 in lieu fee payment. She also suggested the project team point out the temporary impacts to NOAA, and that the project's temporary impacts may also need an in-lieu-fee payment. Mr. Cristoff said that would be up to Mike Hicks at USACE.

Ms. Sommer asked if the pier will be put in the existing footprint. Mr. Murphy said they will overlap but the new pier will be offset slightly. Mr. Cristoff asked what the approximate temporary impacts of the spuds and trestles would be. Mr. Murphy said, if used, a trestle would have approximately 300 sf of temporary impact. Mr. Cristoff said temporary impacts should be based on spud size and number, and an assumption made on the number of barge movements.

Carol Henderson with NHFG said that in a prior meeting they'd requested additional eel grass survey. Stephanie Dyer-Carroll with FHI said that the project team initially surveyed in November 2013, but then went back out in August 2014. Ms. Henderson said Fred Short at the University of New Hampshire had done additional surveys since 2014. The project team should also consult the NH Granite layers. Ms. Henderson said the surveys should be undertaken as close to the construction date as possible.

Mr. Murphy asked if an Individual 401 Water Quality Certification will be required if there's no Individual 404 Permit. Jim Rousseau with the USCG said that they just need something stating that water quality is covered. Mr. Cristoff said the USACE 401 requirements would be covered under a PGP.

*This project has been previously discussed at the 3/20/13 and 1/15/14 Monthly Natural Resource Agency Coordination Meetings.*

**Statewide, #27287 (X-A003(473))**

This project involves the placement of stone protection at six locations to repair scour issues on a number of bridges. Each of the sites were assessed individually and it is the intent of the Department to permit each site independently but advertise all the sites as one contract.

Cornish 172/148 NH Route 120 over Blow Me Down Brook

The proposed work involves placing stone on the northern abutment footing; both downstream wing walls, and the northern upstream wing wall. There was some discussion the sediment control during the installation of the stone and small sediment island that has formed near the southern

downstream wing wall. The work will not involve any dredge; just placement of stone in existing scour holes and the stone will be placed on top of the existing silt. Access will be from the southern upstream wing wall bank. The ACOE was concerned about leaving as much natural channel as possible. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

Hinsdale 132/113 NH route 63 over the Ashuelot River

The proposed work involves placing stone on both abutments, all four wing walls and the pier. Access to the river will be from the northerly and southerly downstream embankments. There are utility corridors on both sides of the river; overhead electric on the north and underground sewer on the south. NH Wetlands requested red maples be replanted once the work is complete to restore the banks. A causeway will be constructed from the north banks to the pier. The wetlands application will be sent to the Ashuelot Local Advisory Committee. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

Lebanon 097/112, 098/111, 099/111, I-89 over the Mascoma River

The proposed work involves placing stone on both embankments and northerly piers. Access to the northerly embankment will be from the northbound barrel and access to the southerly embankment and piers will be from Truck road. Mark noted the depth of the scour within the bridge as almost 6 feet as the stone covered the exposed footing by three feet and there was at least three feet to the water line in the pictures. There were some questions about the knotweed in the project and it was discussed that it would not be spread by the proposed action. The ACOE encourage the Department to keep the stone flat at the waterline to accommodate wildlife passage. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

Peterborough 108/116 US 202/NH Route 123 over the Contoocook River

The proposed work involves placing stone around the pier. Access will be from the southerly downstream embankment. ACOE discussed possible floodway and floodplain impacts and it was agreed there would be none for this proposed work. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

Plainfield 162/100, NH Route 120 over Bloods Brook

The proposed work involves placing stone on both abutments, and both upstream wing walls. Access will be from the easterly upstream bank. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

Westmoreland 109/124 NH Route 63 over Mill Brook

The proposed work involves placing stone on the southerly upstream wing wall. Also included are five bendway weirs to address severe erosion on the southerly upstream bank. Gino commented that the bendway weirs looked like they needed to be turned upstream more and requested we coordinate with USGS on the fluvial geomorphology. The group agreed this was a good approach to address the scour at this location. Access will be from the southern upstream bank. The NH

\* bank. The NH Wetlands Bureau indicated no mitigation was necessary for the work and the ACOE confirmed this work would qualify under the PGP.

*This project has not been previously discussed at a Monthly Natural Resource Agency Coordination Meeting.*

**Nashua-Merrimack-Bedford, #13761 (IM-0931(201))**

This project involves widening approximately 7.5 miles of Everett Turnpike from two lanes to three in each direction. The purpose of this agenda item was to discuss the ongoing alternative analysis of the Pennichuck Brook crossing and reach a concurrence on a preferred alternative, and to introduce the alternatives developed for the Naticook Brook crossing.

Due to recent project developments, Mr. Evans informed the group that the Naticook Brook alternatives would not be presented and discussed during this meeting.

Pennichuck Brook Alternatives 2, 4, 5, 6, and 7 had been discussed at the October 19, 2016 meeting, and it was agreed at that time that they could be eliminated from further consideration.

A new alternative (Alternative 8) for the Pennichuck Brook crossing was developed through comments and discussion that occurred during the February 15, 2017 meeting. This alternative involves a 19-foot shift of the roadway centerline to the east. This shift will eliminate impacts to the causeway and Pennichuck Brook on the west side of the Everett Turnpike. Alternative 8 consists of 2:1 vegetated side slopes, with approximately 24,700 square feet of impacts below ordinary high water, with an estimated construction cost of 6.7 million dollars. This alternative has significantly lower impacts to lands below ordinary high water in Pennichuck Brook as compared to Alternatives 1 and 3 with similar 2:1 side slopes. Alternative 8 is also the cheapest option, due to a reduction in environmental mitigation costs.

A question was asked regarding the construction sequence. Mr. Kull explained that the project would be constructed in a 3-phase approach over three construction seasons. First, two lanes of the new bridge would be constructed east of the existing bridge. In the second phase NB traffic would be moved to the newly constructed roadway and the existing southbound bridge would be replaced, and in the third phase SB traffic would be moved to the new roadway and the existing northbound bridge would be replaced.

Ms. Sommer inquired as to which construction phase the impacts to lands below ordinary high water would occur. Mr. Kull indicated that these impacts would occur during the first phase.

Mr. Urban asked about placing stone fill around the new abutments. Mr. Kull explained that the proposed abutments will be founded on piles driven to bedrock at a depth of approximately 35 feet. The proposed abutments will be set behind the existing ones, and the proposed span length will be increased from 85 to approximately 100 feet.

Mr. Infascelli noted that Alternative 8 minimizes the linear feet of shoreline impacts along Pennichuck Brook, which is a significant benefit.

## Mitigation Narrative

Statewide 27287

Through the discussions at the May 17, 2017 Natural Resource Agency Coordination meeting The NH Wetlands Bureau indicated no mitigation was necessary as this work was protection of existing infrastructure.

## StreamStats Report

**Region ID:**

NH

**Workspace ID:**

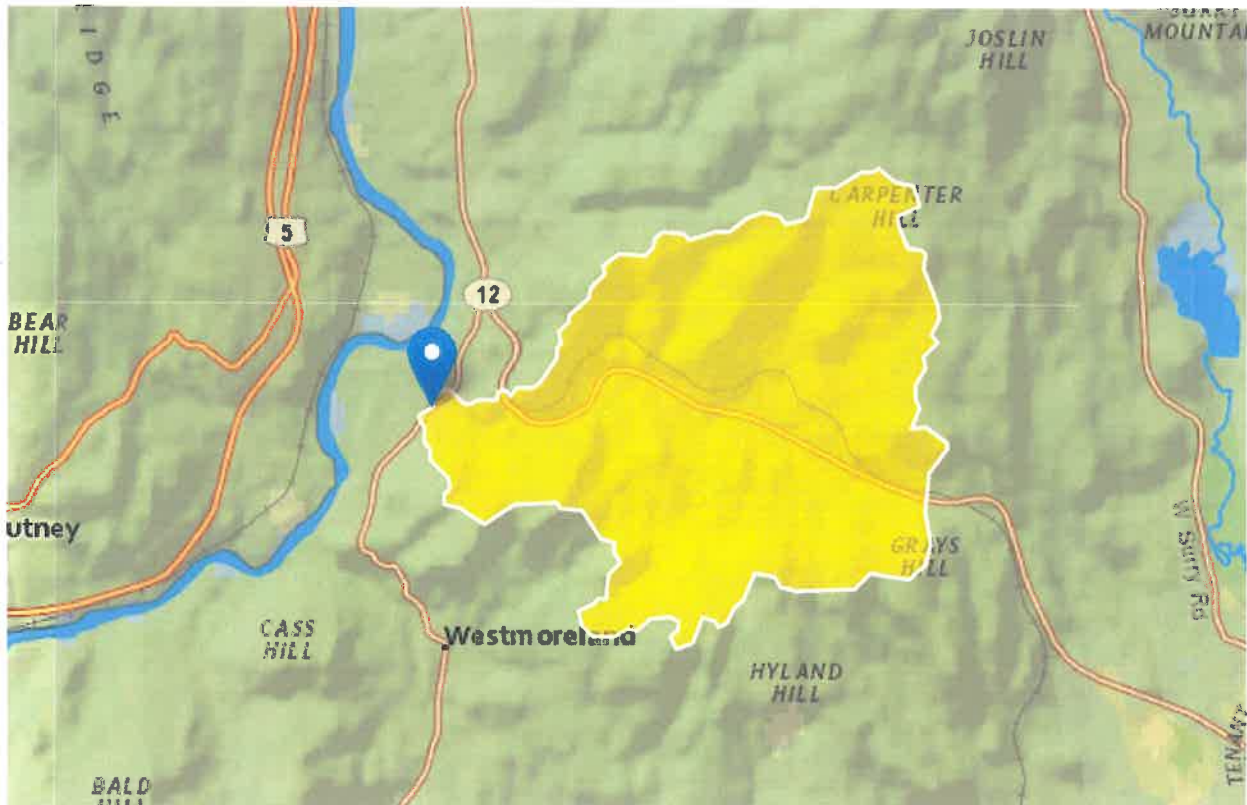
NH20170707112113593000

**Clicked Point (Latitude, Longitude):**

42.99167, -72.44546

**Time:**

2017-07-07 11:22:07 -0400



### Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	11.24	square miles
CONIF	Percentage of land surface covered by coniferous forest	21.1521	percent

**NH Department of Transportation  
Bureau of Bridge Design  
Statewide 27287 – Westmoreland Br. No. 109/124  
Env-Wt 904.09 Alternative Design  
TECHNICAL REPORT**

**Env-Wt 904.09(a) - If the applicant believes that installing the structure specified in the applicable rule is not practicable, the applicant may propose an alternative design in accordance with this section.**

Please explain why the structure specified in the applicable rule is not practicable (Env-Wt 101.69 defines practicable as *available and capable of being done after taking into consideration costs, existing technology, and logistics in light of overall project purposes.*)

**Mill Brook has a drainage area of 5.2 square miles which qualifies this stream as a Tier 3 Crossing. The required span based on the NH Stream Crossing Guidelines for a new crossing would be 36 feet. A structure of this size would typically cost approximately \$700,000. Spending this much money on a structure that could be adequately preserved for approximately \$20,000 would not be a practicable use of resources. There would be an increase in bank impacts and likely more wetland impacts if a structure of this size were installed due to the additional footprint for construction.**

**The proposed alternative meets the specific design criteria for Tier 2 and Tier 3 crossings to the maximum extent practicable, as specified below.**

**Env-Wt 904.05 Design Criteria for Tier 2 and Tier 3 Stream Crossings – New Tier 2 stream crossings, replacement Tier 2 crossings that do not meet the requirements of Env-Wt 904.07, and new and replacement Tier 3 crossings shall be designed and constructed:**

(a) In accordance with the NH Stream Crossing Guidelines.

**The NH Stream Crossing Guidelines do not mention maintenance to a structure in a Tier 3 watershed.**

**The proposed scour preservation work will match the existing slope and alignment.**

**The bottom of the existing structure will not be changed as a result of this project.**

**Wildlife passage will remain the same through the existing structure.**

**The proposed work will maintain the flow depths found in the existing structure.**

**The proposed work will still allow the 100 year flood event to pass.**

(b) With bed forms and streambed characteristics necessary to cause water depths and velocities within the crossing structure at a variety of flows to be comparable to those found in the natural channel upstream and downstream of the stream crossing.

**Water depths and velocities within the crossing at a variety of flows will be comparable to the existing depths and velocities. These flows are comparable to those found in the natural channel upstream and downstream of the stream crossing.**

(c) To provide a vegetated bank on both sides of the watercourse to allow for wildlife passage.

**The scour preservation work entails replacing rip-rap to replace where stone previously existed but has scoured away. The riprap banks were not previously vegetated.**

(d) To preserve the natural alignment and gradient of the stream channel, so as to accommodate natural flow regimes and the functioning of the natural floodplain.

**Bendway weirs will be placed to stop bank erosion and to reestablish the natural alignment and gradient of the stream channel prior to the scour and erosion taking place. The existing structure can pass the 100 year storm event and this project will not change the capacity. Surface waters will not be reflected or redirected as a result of this project.**

(e) To accommodate the 100-year frequency flood, to ensure that (1) there is no increase in flood stages on abutting properties; and (2) flow and sediment transport characteristics will not be affected in a manner which could adversely affect channel stability.

**The riprap will not alter the potential of flooding. The existing structure can pass the 100 year storm event and this project will not change the capacity. The project as proposed will not alter the chance of flooding on abutting properties. Flow and sediment transport characteristics will be restored back to the conditions prior to the scour.**

(f) To simulate a natural stream channel.

**The stream channel is currently a natural bottom and will not be changed as a result of this project.**

(g) So as not to alter sediment transport competence.

**Nothing that will be a barrier to sediment transport will be installed in this project. The bendway weirs are intended to direct flow back to the thalweg and are not expected to trap any sediment. It would be expected that any sediment would also be directed towards the thalweg.**

**Env-Wt 904.09(c)(3) – The alternative design must meet the general design criteria specified in Env-Wt 904.01:**

Env-Wt 904.01

(a) Not be a barrier to sediment transport;

**Nothing that will be a barrier to sediment transport will be installed in this project.**

(b) Prevent the restriction of high flows and maintain existing low flows;

**The rip-rap for scour protection and the bendway weirs for bank erosion protection will not alter the existing high and low flows.**

(c) Not obstruct or otherwise substantially disrupt the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction;

**The degree of aquatic passage will remain the same through the existing structure. Conditions will not deteriorate or be enhanced by the proposed work.**

(d) Not cause an increase in the frequency of flooding or overtopping of banks;

**The rip-rap for scour protection will not alter the potential of flooding. The structure can pass the 100 year storm event and this project will not change the capacity. The project as proposed will not alter the chance of flooding on abutting properties.**

(e) Preserve watercourse connectivity where it currently exists;

**Connectivity will remain unchanged with the proposed structure.**

(f) Restore watercourse connectivity where: (1) Connectivity previously was disrupted as a result of human activity(ies); and (2) Restoration of connectivity will benefit aquatic life upstream or downstream of the crossing, or both;

**Connectivity will remain unchanged with the proposed structure and will not be worsened. Aquatic life upstream and downstream will not be affected as a result of this project.**

(g) Not cause erosion, aggradation, or scouring upstream or downstream of the crossing; and

**The riprap and bendway weirs will prevent erosion and scour, and reestablish the natural alignment and gradient of the stream channel.**

(h) Not cause water quality degradation.

**The project as proposed will not impact the quantity or quality of surface and/or groundwater at this site. Best Management Practices will be used to prevent any adverse effect to water quality during construction.**

**\*\*\*Note: An alternative design for Tier 1 stream crossings must meet the general design criteria (Env-Wt 904.01) only to the *maximum extent practicable*.**



## New Hampshire Natural Heritage Bureau

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**To:** Sarah Large  
7 Hazen Drive  
Concord, NH 03301

**Date:** 11/30/2016

**From:** NH Natural Heritage Bureau

**Re:** Review by NH Natural Heritage Bureau of request dated 11/30/2016  
NHB File ID: NHB16-3592

**Applicant:** NHDOT

**Location:** Tax Map(s)/Lot(s):  
Westmoreland

**Project Description:** Installation of bridge scour protection for bridge 109/124 in  
Westmoreland- NH Route 63 over Mill Brook.

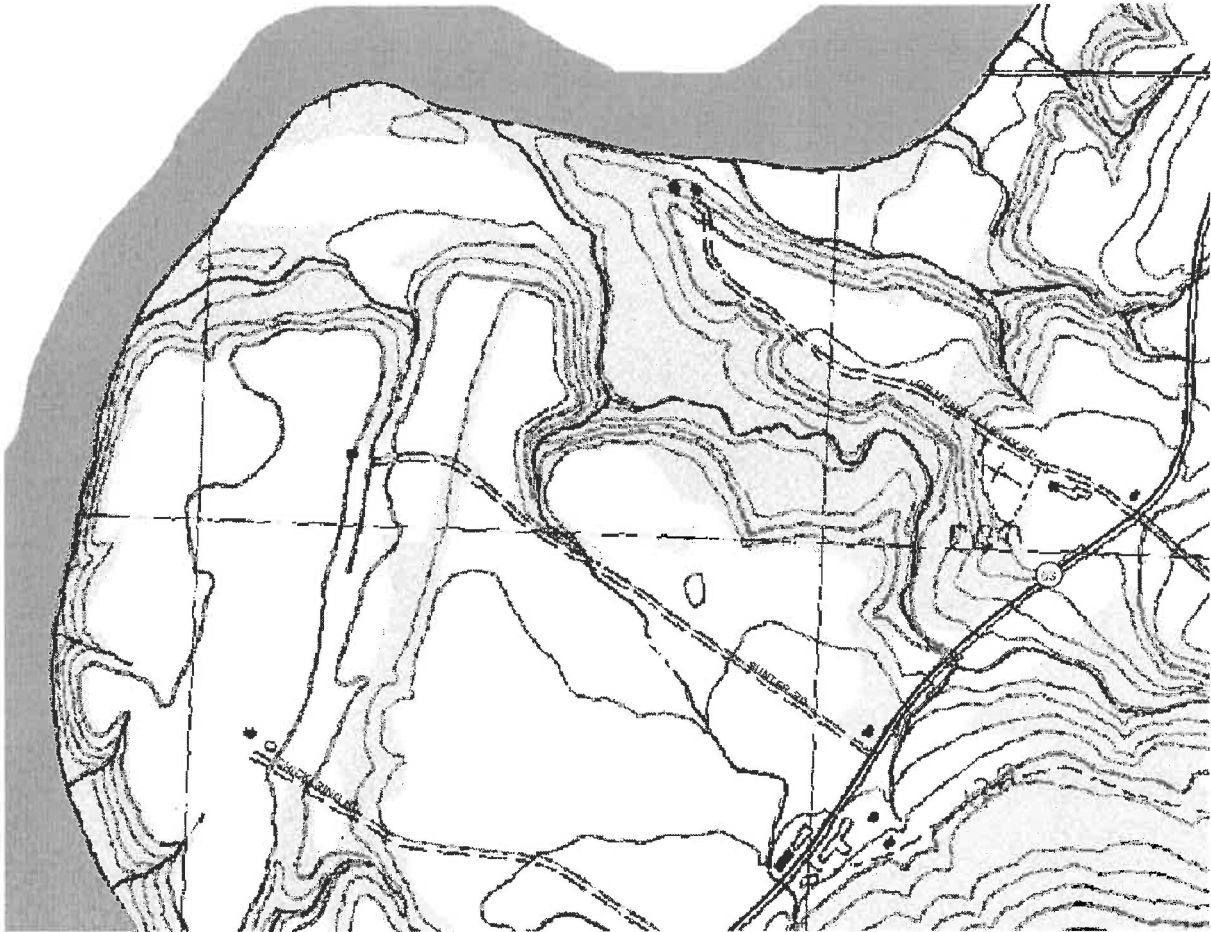
The NH Natural Heritage database has been checked for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government. We currently have no recorded occurrences for sensitive species near this project area.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

This report is valid through 11/29/2017.



MAP OF PROJECT BOUNDARIES FOR NHB FILE ID: NHB16-3592





## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
New England Ecological Services Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5094  
Phone: (603) 223-2541 Fax: (603) 223-0104  
<http://www.fws.gov/newengland>



In Reply Refer To:  
Consultation Code: 05E1NE00-2017-SLI-1795  
Event Code: 05E1NE00-2017-E-03930  
Project Name: Statewide 27287

June 08, 2017

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

### To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the

human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan ([http://www.fws.gov/windenergy/eagle\\_guidance.html](http://www.fws.gov/windenergy/eagle_guidance.html)). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

## Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**New England Ecological Services Field Office**  
70 Commercial Street, Suite 300  
Concord, NH 03301-5094  
(603) 223-2541

## Project Summary

Consultation Code: 05E1NE00-2017-SLI-1795

Event Code: 05E1NE00-2017-E-03930

Project Name: Statewide 27287

Project Type: TRANSPORTATION

**Project Description:** The Statewide 27287 Project involves the placement of stone protection at six locations to repair scour issues on a number of bridges.

- Cornish 172/148 NH Route 12 over Blow Me Down Brook: The proposed work involves placing stone on the northern abutment footing; both downstream wing walls, and the northern upstream wing wall.
- Hinsdale 132/113 NH route 63 over the Ashuelot River: The proposed work involves placing stone on both abutments, all four wing walls and the pier. Access to the river will be from the northerly and southerly downstream embankments.
- Lebanon 097/112, 096/011, 099/111, I-89 over the Mascoma River: The proposed work involves placing stone on both embankments and northerly piers. Access to the northerly embankment will be from the northbound barrel and access to the southerly embankment and piers will be from Truck road.
- Peterborough 108/116 NH Route 9 over the Contoocook River: The proposed work involves placing around the pier. Access will be from the southerly downstream embankment. ACOE discussed possible floodway and floodplain impacts and it was agreed there would be none for this proposed work.
- Plainfield 162/100, NH Route 120 over Blood Brook: The proposed work involves placing stone on both abutments, and both upstream wing walls. Access will be from the easterly upstream bank.
- Westmoreland 109/129 NH Route 63 over Mill Brook: The proposed work involves placing stone on the southerly upstream abutment and wing wall. Also included are five bendway weirs address severe erosion on the southerly upstream bank.

**Project Location:**

Approximate location of the project can be viewed in Google Maps:

<https://www.google.com/maps/place/42.99145541314799N72.44521671667101W>



Counties: Cheshire, NH | Grafton, NH | Hillsborough, NH | Sullivan, NH

## Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area. Please contact the designated FWS office if you have questions.

### Mammals

NAME	STATUS
Northern Long-eared Bat ( <i>Myotis septentrionalis</i> )	Threatened
No critical habitat has been designated for this species.	
Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	

### Critical habitats

There are no critical habitats within your project area.

# Section 106 Programmatic Agreement – Cultural Resources Review Effect Finding

## Appendix B Certification – Projects with Minimal Potential to Cause Effects

Date Reviewed: 6/5/2017

Project Name: Statewide

State Number: 27287

FHWA Number: X-A003(473)

Environmental Contact: Mark Hemmerlein

DOT

Email Address: Mhemmerlein@dot.state.nh.us

Project

Dave Scott

Manager:

**Project Description:** Actions to stabilize various bridges from scour, including placement of stone in the river channels and banks. Proposed right of entry to the rivers involves constructing temporary access roads down the banks and stone causeways in the rivers. Work will be completed on six (6) bridge locations: Cornish (172/148) NH route 120 over Blow-Me-Down Brook, Hinsdale 132/113 NH Route 63 over the Ashuelot River, Lebanon (097/112, 098/111, 099/111) I-89 over the Mascoma River, Peterborough (108/116) US Route 202 over the Contoocook River, Plainfield (162/100) NH Route 120 over Blood Brook, and Westmoreland (109/124) NH Route 63 over Mill Brook)

Please select the applicable undertaking type(s):

<input type="checkbox"/>	1. Modernization and general highway maintenance <b>that may require additional highway right-of-way or easement</b> , and which is <b>not within the boundaries of a historic property or district</b> , including:
	Choose an item. Choose an item.
<input type="checkbox"/>	2. Non-historic bridge and culvert maintenance, renovation, or total replacement, <b>that may require minor additional right-of-way or easement</b> , and which is <b>not within the boundaries of a historic property or district</b> , including:
	Choose an item. Choose an item.
<input type="checkbox"/>	3. Historic bridge maintenance activities within the limits of existing right-of-way, including:
	Choose an item. Choose an item.
<input checked="" type="checkbox"/>	4. Stream stabilization and restoration activities (including removal of debris or sediment obstructing the natural waterway, or any non-invasive action to restore natural conditions).
<input type="checkbox"/>	5. Construction of bicycle lanes and pedestrian walkways, sidewalks, shared-use paths and facilities, small passenger shelters, and alterations to facilities or vehicles in order to make them accessible for elderly and handicapped persons, <b>not within the boundaries of a historic property or district</b> .
<input type="checkbox"/>	6. Installation of bicycle racks, <b>not within the boundaries of a historic property or district</b> .
<input type="checkbox"/>	7. Recreational trail construction, <b>not within the boundaries of a historic property or district</b> .
<input type="checkbox"/>	8. Recreational trail maintenance when done on existing alignment.
<input type="checkbox"/>	9. Modernization, maintenance, and safety improvements of railroad facilities within the existing railroad or highway right-of-way, <b>not within the boundaries of a historic property or district, and no historic railroad features are impacted</b> , including, but not limited to:
	Choose an item. Choose an item.
<input type="checkbox"/>	10. Acquisition or renewal of scenic, conservation, habitat, or other land preservation easements
<input type="checkbox"/>	11. Installation of Intelligent Transportation Systems.

## Section 106 Programmatic Agreement – Cultural Resources Review Effect Finding

### Appendix B Certification – Projects with Minimal Potential to Cause Effects

Please describe how this project is applicable under Appendix B of the Programmatic Agreement.

The sites were reviewed by the NHDOT BOE Cultural Resources program staff. It was determined that there were no historic resources at any of the sites that would be impacted by the proposed action. In addition, access to the water was reviewed and in all cases the access was over ground that was previously disturbed by prior bridge construction or utility installations. There will be no impacts to existing bridge components including but not limited to decks, abutments or piers.


*NHDOT in-house projects: Please append photographs, USGS maps, design plans and as-built plans, if available, for review.*

*LPA projects: Please submit this Certification Form along with the Transportation RPR*

#### Coordination Efforts:

Has an RPR been submitted to NHDOT for this project?	Not Applicable	NHDHR R&C # assigned?	N/A
Please identify public outreach effort contacts; method of outreach and date:	<u>None; these are bridge maintenance activities.</u>		

Finding: (To be filled out by NHDOT Cultural Resources Staff )

<input checked="" type="checkbox"/>	<b>No Potential to Cause Effects</b>	<input type="checkbox"/>	<b>No Historic Properties Affected</b>
This finding serves as the Section 106 Memorandum for your environmental documents, no further coordination is necessary.			
<input type="checkbox"/>	<b>This project does <i>not</i> comply with Appendix B, and will continue under the Section 106 review process outlined in 36 CFR 800.3-800.7. Please contact NHDOT Cultural Resources Staff to determine next steps.</b>		
<div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="text-align: center;">               _____              NHDOT Cultural Resources Staff         </div> <div style="text-align: center;">             6/5/2017              _____              Date         </div> </div>			

Coordination of the Section 106 process should begin as early as possible in the planning phase of the project (undertaking) so as not to cause a delay.

Project sponsors should not predetermine a Section 106 finding under the assumption that an undertaking conforms to the types listed in Appendix B until this form is signed by the NHDOT Bureau of Environment Cultural Resources Program staff.

Every project shall be coordinated with, and reviewed by the NHDOT-BOE Cultural Resources Program in accordance with the Cultural Resources Programmatic Agreement among the Advisory Council on Historic Preservation, Federal Highway Administration, NH Department of Transportation, and the State Historic Preservation Office. In accordance with the Advisory Council's regulations, we will continue to consult, as appropriate, as this project proceeds.

If any portion of the undertaking is not entirely limited to any one or a combination of the types specified in Appendix B (with, or without a portion that is included as a type listed in Appendix A), please continue discussions with NHDOT Cultural Resources staff.

## **Section 106 Programmatic Agreement – Cultural Resources Review Effect Finding**

### **Appendix B Certification – Projects with Minimal Potential to Cause Effects**

This No Potential to Cause Effect or No Historic Properties Affected project determination is your Section 106 finding, as defined in the Programmatic Agreement.

Should project plans change, please inform the NHDOT Cultural Resources staff in accordance with Stipulation VII of the Programmatic Agreement.



US Army Corps  
of Engineers®  
New England District

**U.S. Army Corps of Engineers**  
**New Hampshire Programmatic General Permit (PGP)**  
**Appendix B - Corps Secondary Impacts Checklist**  
**(for inland wetland/waterway fill projects in New Hampshire)**

1. Attach any explanations to this checklist. Lack of information could delay a Corps permit determination.
2. All references to "work" include all work associated with the project construction and operation. Work includes filling, clearing, flooding, draining, excavation, dozing, stumping, etc.
3. See PGP, GC 5 regarding single and complete projects.
4. Contact the Corps at (978) 318-8832 with any questions.

<b>1. Impaired Waters</b>	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See <a href="http://des.nh.gov/organization/divisions/water/wmb/section401/impaired_waters.htm">http://des.nh.gov/organization/divisions/water/wmb/section401/impaired_waters.htm</a> to determine if there is an impaired water in the vicinity of your work area.*		X
<b>2. Wetlands</b>	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to SAS, shellfish beds, special wetlands and vernal pools (see PGP, GC 26 and Appendix A)? Applicants may obtain information from the NH Department of Resources and Economic Development Natural Heritage Bureau (NHB) website, <a href="http://www.nhnaturalheritage.org">www.nhnaturalheritage.org</a> , specifically the book <u>Natural Community Systems of New Hampshire</u> .		X
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)	X	
2.5 The overall project site is more than 40 acres.		X
2.6 What is the size of the existing impervious surface area?	0	
2.7 What is the size of the proposed impervious surface area?	0	
2.8 What is the % of the impervious area (new and existing) to the overall project site?	0	
<b>3. Wildlife</b>	Yes	No
3.1 Has the NHB determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project? (All projects require a NHB determination.)		X
3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: <ul style="list-style-type: none"> <li>• PDF: <a href="http://www.wildlife.state.nh.us/Wildlife/Plan/highest_ranking_habitat.htm">www.wildlife.state.nh.us/Wildlife/Plan/highest_ranking_habitat.htm</a>.</li> <li>• Data Mapper: <a href="http://www.granit.unh.edu">www.granit.unh.edu</a>.</li> <li>• GIS: <a href="http://www.granit.unh.edu/data/downloadfreedata/category/databycategory.html">www.granit.unh.edu/data/downloadfreedata/category/databycategory.html</a>.</li> </ul>		X
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the PGP, GC 21?	X	

4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?	N/A	
5. Historic/Archaeological Resources		
If a minor or major impact project, has a copy of the Request for Project Review (RPR) Form ( <a href="http://www.nh.gov/nhdhr/review">www.nh.gov/nhdhr/review</a> ) been sent to the NH Division of Historical Resources as required on Page 5 of the PGP?**	X	

\*Although this checklist utilizes state information, its submittal to the Corps is a Federal requirement.

\*\* If project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.



Snowmobile (foreground) and Highway Bridge



Upstream Southern bank



Scoured bank (placement of bendway wiers)

## Westmoreland Br. No. 109/124 Construction Sequence

All activities to use BMP for erosion control

1. Set up Perimeter Control
2. Install water diversion structure (if needed)
3. Construct stable access points (SE corner)
4. Install stone fill at SE wingwall
5. Install bendway weirs along SE bank
6. Remove access
7. Stabilize access area

**PART WT 404 CRITERIA FOR SHORELINE STABILIZATION**

The NH 63 over Mill Brook preservation response to stabilize the bridges from scour proposes the placement of rip-rap within the jurisdictional areas of the N.H. Wetlands Bureau and the U.S. Army Corps of Engineers. Rip-rap will be placed at the abutment bank slopes of the existing bridge. Riprap previously existed there but from large storm events the stone has been scoured away. Bendway weirs will be placed upstream to alleviate bank erosion.

Pursuant to PART Wt 404 Criteria for Shoreline Stabilization, the following addresses each codified section of the Administrative Rules:

Wt 404.01 Least Intrusive Method

The shoreline stabilization treatment proposed is the least intrusive construction method necessary to protect the existing shorelines from further scour and to protect the structural integrity of the bridge. The stone treatment can be reasonably constructed utilizing general highway construction methods.

Wt 404.02 Diversion of Water

The area where the rip-rap is being replaced will be behind either a cofferdam or water diversion structure so that Mill Brook can continue to flow in front of the diversion.

Wt 404.03 Vegetative Stabilization

Natural vegetation will be left undisturbed to the maximum extent possible. The only locations being disturbed are the areas that previously had stone and the area of the south bank where the bendway weirs will be placed. All Temporary impacts will be re-vegetated and stabilized.

Wt 404.04 Rip-Rap

- (a) Proposed stone fill as shown on the attached plans is to protect the existing embankments in front of the abutments and wingwalls from erosion and scour and protect the upstream southwest bank from further erosion. Stable embankments are necessary to maintain the structural integrity of the bridge during all instances of flood flows.
- (b) (1-5) The enclosed specifications for Rip-Rap Class V (Item 583.5) provides the description of the material size, gradation, and construction requirements. Cross sections of the stone fill showing proposed thickness and other details, including Geotextile, Permanent Control Class 1, Non-Woven (Item 593.411) have been provided on the attached plans. Bedding for the stone fill will consist of natural ground excavated to the proposed underside of the stone fill in conformance with Section 203 of the Specifications.
- (b) (6) Enclosed are plan sheets to sufficiently indicate the relationship of the project to fixed points of reference, abutting properties, and features of the natural shoreline.
- (b) (7) For reasons as explained in Section (a), rip-rap is recommended for the limits shown on the attached plans.
- (c) N/A

- (d) Stone fill is proposed to extend down to and adequately key into the stream channel bottom to prevent possible undermining of the shore slope. The bendway weirs will extend into the channel to redirect flow towards the thalweg of the channel. This will involve extending the stone beyond the two foot limit as specified in the Criteria for Shoreline Stabilization, Wt 404.04.
- (e) Engineering plans are being provided as a part of the application for rip-rap in excess of 100 linear feet along the stream bank (approximately 104 linear feet of along the south stream bank). Since the project has not advertised final stamped plans are not available. It is not anticipated that the location of the rip-rap will change therefore the plans are stamped with the understanding that if the location of the rip-rap changes, DES will be notified accordingly.

**SECTION 583 -- RIPRAP****Description**

**1.1** This work shall consist of furnishing and placing riprap as shown on the plans or ordered. Riprap is typically required for erosion protection of bridge structures in waterways, for active waterway channel slopes and bottoms, and for intermittent waterway channels where the Engineer determines riprap protection is required to resist expected high water flow velocities.

**Materials**

**2.1** Riprap shall be quarry stone of approved quality, hard, durable, sub-angular to angular in shape, resistant to weathering and free from structural defects such as weak seams and cracks.

**2.1.1** The suitable shape of the individual stones shall be angular, meeting the gradation in 2.1.1.2 to create interlocking riprap to provide stability of the slope or channel. Round, thin and platy, elongated or needle-like shapes shall not be used.

**2.1.1.1** The suitable riprap stone shape is determined by the Length to Thickness ratio, where Length is the longest dimension and Thickness is the shortest dimension, measured in perpendicular axes to each other. The suitable riprap stone shape shall have a length to thickness ratio of no greater than 3.

**2.1.1.2** The gradation requirements of the riprap classes in Table 583-1 are based on the stone size Width, the largest dimension perpendicular to the Length and Thickness, and the distribution of stone sizes by volume. The volume distribution requires that 15 percent of the stone in the mass shall be no larger than the volume shown in the table (< 15% column), and 15 percent of the stone in the mass shall be no smaller than the volume shown in the table (> 85% column). The remaining 70 percent of the stone in the mass shall have a volume between these requirements, averaging to the volume shown in the table (15% - 85% column). None of the stones in the mass shall exceed the maximum volume shown in the table (Maximum column).

**Table 583-1**

Riprap Classes and Sizes			Percentage Distribution of Particle Sizes by Volume (cubic feet)			
Class	Nominal Size (in)	Maximum Size (in)	< 15%	15% - 85%	> 85%	Maximum
I	6	12	0.05	0.14	0.31	1.0
III	12	24	0.4	1.0	2.5	6.5
V	18	36	1.3	3.5	8.5	22
VII	24	48	3	8	19	53
IX	36	72	10	27	65	179

Note: Nominal Size and Maximum Size are based on the Width dimension of the stone. The riprap classes conform to the standard classes described in the FHWA HEC-23 publication.

**2.1.2** The sources from which the stone is obtained shall be selected well in advance of the time when the material will be required in the field. The acceptability of the riprap stone shape and grading will be determined by the Engineer.

**2.1.3** Control of the gradation will be completed by visual inspection approval by the Engineer of a stockpile at the quarry or other agreed site. Mechanical equipment as needed to assist in checking the stockpile gradation shall be provided by the Contractor. Stockpile replenishment will require re-approval.

**2.2** Gravel blanket material shall conform to 209.2.1.2.

**2.3** Geotextile shall conform to 593.2.

**Construction Requirements**

**3.1 Preparation of slopes.** Slopes that will be covered by riprap shall be free of brush, trees, stumps, and other organic material and shall be graded to a smooth surface. All soft material shall be removed to the depth shown on the plans or as directed and replaced with approved material per 203.3.6. It is the Contractor's responsibility to protect embankments and excavated slopes from erosion during construction of the riprap covered slope.

**3.2 Gravel blanket construction.** When called for on the plans, the gravel blanket shall be placed on the prepared area to the specified thickness in one operation, using methods which will not cause segregation of particle sizes within the layer. The surface of the finished layer shall be even and free from mounds or windrows.

**3.3 Geotextile placement.** Geotextile shall be placed in accordance with 593.3.

**3.4 Riprap placement.** Riprap shall be constructed to the dimensions shown on the plans or as directed by the Engineer.

**3.4.1** Placement of riprap shall be conducted as soon as possible after gravel blanket or geotextile placement.

**3.4.2** Placement of the riprap shall be started at the toe (key trench) and progress up the slope. The key trench at the bottom of the riprap shall be constructed as shown on the plans. If bedrock is encountered at the key trench it shall be brought to the attention of the Engineer to determine if modification to the riprap installation is needed.

**3.4.3** Riprap shall be placed over geotextile by methods that do no stretch, tear, puncture or reposition the fabric. Riprap smaller than 1.5 cu. ft. in volume shall be placed with drop heights of less than 3 ft. to the placement surface. Riprap greater than 1.5 cu. ft. in volume shall be placed with no free fall height.

**3.4.4** Equipment such as a clamshell, orange-peel bucket, skip or hydraulic excavator shall be used to place the riprap so it is well distributed and there is no large accumulations of either the larger or smaller sizes of stone. Dump trucks or front-end loaders tracked or wheeled vehicles shall not be used since they can destroy the interlocking integrity of the stone when driven over previously placed riprap. Placing the riprap by end dumping on the slopes will cause segregation and will not be permitted.

**3.4.5** The riprap shall be placed in a manner which produces a well-graded mass. The larger stones shall be well distributed and the entire mass of riprap shall conform approximately to the gradation specified. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure the uniformity of gradation and surface specified. Fill voids between larger stones with small stones to ensure interlocking between the riprap.

**3.4.6** After the riprap is in place, it shall be compacted by impacting (ramming) the exposed surface to produce a tight, locked surface, not varying more than 6" from the elevations shown on the plans.

**3.4.7** Riprap placed in water requires close observation and increased quality control to ensure the required thickness, gradation and coverage is achieved.

#### Method of Measurement

**4.1** Riprap will be measured by the cubic yard.

**4.1.1** If the Engineer determines that in-place measurement is impracticable, the quantity for payment will be determined by loose measure in the hauling vehicle on the basis that 1 cubic yard vehicle measure is equivalent to 0.7 cubic yard in place.

#### Basis of Payment

**5.1** The accepted quantity of riprap will be paid for at the Contract unit price per cubic yard (cubic meter) complete in place.

**5.1.1** Only when the stone is examined in accordance with 2.1 and examination proves the gradation to be acceptable will payment be made as provided in 109.04.

**5.1.2** Gravel blanket material specified or ordered will be paid for under Section 209.

**5.1.3** Geotextile specified or ordered will be paid for under Section 593.

**5.1.4** The accepted quantity of excavation required for placing riprap and for placing any underlying gravel blanket will be paid for under the item of excavation being performed. Excavation above refers only to excavation of original ground or to material ordered removed not shown on the plans.

**5.1.5** Free borrow will not be required to replace the accepted quantity of stone obtained from the excavation. However, when the plans do not call for borrow but the quantity of material removed from excavation for use under this item requires the Contractor to furnish borrow to complete the work, such borrow will be subsidiary.

**5.1.6** Replacement slope material resulting from the requirements of 3.1 will be paid in accordance with 203.5.1.9.

#### Pay item and unit:

583.1	Riprap, Class I	Cubic Yard
583.3	Riprap, Class III	Cubic Yard
583.5	Riprap, Class V	Cubic Yard
583.7	Riprap, Class VII	Cubic Yard
583.9	Riprap, Class IX	Cubic Yard

**SECTION 593 -- GEOTEXTILE****Description**

**1.1** This work shall consist of furnishing and installing geotextile fabric as shown on the plans or as ordered, including any labor and materials needed to anchor, splice, or repair the geotextile.

**Materials****2.1 General.**

**2.1.1** Geotextile shall be a product tested under the AASHTO National Transportation Product Evaluation Program (NTPEP) and included on the Qualified Products List for the Application, Strength Class, and Structure specified. Manufacturers of geotextiles and those marketing geotextiles made by others as a "Private Labeler" shall participate in and maintain compliance with the NTPEP audit program for geotextiles. Manufacturer's labels providing product name, AASHTO M288 class, roll number, and production date shall be affixed to both ends of the roll.

**2.1.2** All geotextile properties referenced in the specifications and certified by the Contractor, with the exception of Apparent Opening Size (AOS), shall be considered minimum average roll values in the weaker principal direction (i.e., the average test results for any sampled roll in a lot shall meet or exceed the minimum values specified). Values for AOS shall represent maximum average roll values.

**2.1.3** Fibers used in the manufacture of geotextiles, and threads used in joining geotextiles by sewing, shall meet the requirements of the most current version of the applicable sections of AASHTO M 288.

**2.1.4** Geotextile shall exhibit an ultraviolet stability (retained strength) of at least 50% after 500 hours of exposure, measured in accordance with ASTM D 4355.

**2.2 Application.**

Following are the basic Applications of geotextile included under this specification. Applications are described according to their most common use(s) and may not include every function for which a geotextile is specified.

**2.2.1** Application 1 – Subsurface Drainage. Geotextile for this Application consists of fabric placed against a soil to allow for long-term passage of water into a subsurface drain system while retaining the in situ soil.

**2.2.2** Application 2 – Separation. Geotextile for this Application consists of fabric placed to prevent mixing of in situ or subgrade soil with aggregate cover materials.

**2.2.3** Application 3 – Stabilization. Geotextile for this Application consists of fabric placed in wet, saturated conditions to provide the coincident functions of separation and filtration. This Application may also be specified for geotextiles used to provide the function of reinforcement.

**2.2.4** Application 4 – Permanent Erosion Control. Geotextile for this Application consists of fabric placed below riprap or other armor systems to prevent soil loss and/or instability of the erosion control system.

**2.3 Strength Class. Following are the basic Strength Classes of geotextile included under this specification:**

**2.3.1** Class 1, Class 2, and Class 3. Geotextile specified as Class 1 (high strength), Class 2 (medium strength), or Class 3 (low strength) shall meet the applicable requirements of AASHTO M 288, Table 1, including sewn seam strength when sewn seams are used. A higher strength geotextile may be substituted for a lower strength geotextile provided all other specification requirements are met.

**2.3.2** Class 0. Geotextile specified as Class 0 (extra high strength) shall meet the following minimum requirements:

Geotextile Property	Test Method	Property Requirement Pounds
Grab Tensile Strength	ASTM D 4632	375
Sewn Seam Strength	ASTM D 4632	335
Tear Strength	ASTM D 4533	135
Puncture Strength	ASTM D 6241	1237

**2.4 Structure.** The Contract Item Number for geotextile includes a designation for Structure that defines the basic composition of the fabric. Geotextile shall conform to the specified structure as identified by the Item Number.

**2.5 Permittivity and Apparent Opening Size (AOS).** Geotextile shall meet the requirements for permittivity and Apparent Opening Size (AOS) as described in the Geotextile Qualification Criteria Document. Located on the Department's Website.

## SECTION 593

**2.6** Each roll shall be clearly labeled so as to easily identify the product in the field. The label shall include as a minimum the manufacturer's name, product name and number, and the Contract Item name and number.

**2.7 Staples or Pins.** Staples or pins required to hold the geotextile prior to placing overlying materials shall be those prescribed by the geotextile manufacturer.

### Construction Requirements

**3.1 Protection of Geotextile.** To prevent damage to the fabric, the Contractor shall exercise necessary care while transporting, storing, and installing the fabric. Prior to installation, the fabric shall be protected from weather, direct sunlight or other ultra-violet exposure, and from dust, mud, dirt, debris, and other elements which may affect its performance. Fabric that is torn, punctured, or otherwise damaged shall not be placed. After placement, fabric shall be covered within 5 days. Traffic or construction equipment shall not be permitted directly on the geotextile.

**3.2 Placement of Geotextile and Overlying Materials.** The geotextile and overlying materials shall be placed in accordance with the plans, the manufacturer's requirements, and the following:

**3.2.1 General.** Prior to placement of the fabric, the site shall be prepared to provide a smooth surface which is free from debris, obstructions, and depressions which could result in gaps, tears, or punctures in the fabric during cover operations.

**3.2.1.1** Successive sheets placed above water shall be overlapped by a minimum of 18". Sheets placed below water shall be sewn or overlapped by a minimum of 3 feet. Larger overlaps may be called for on the plans or required by the Engineer in soft soil conditions or if gaps between adjacent sheets occur during placement of overlying material. Pins or staples may be used to anchor the fabric as directed by the Engineer.

**3.2.2 Subsurface Drainage.** Trench excavation shall be done in accordance with details shown on the plans. In all instances, excavation shall be done in such a way so as to prevent large voids from occurring in the sides and bottom of the trench.

**3.2.2.1** The geotextile shall be placed loosely with no wrinkles or folds, and with no void spaces between the geotextile and the ground surface. Successive sheets shall be shingled such that the upstream sheet is placed over the downstream sheet.

**3.2.2.2** Placement of drainage aggregate shall proceed immediately following placement of the geotextile. The geotextile shall be covered with a minimum of 12" of loosely placed aggregate prior to compaction. If a collector pipe is to be installed in the trench, a bedding layer of drainage aggregate shall be placed below the pipe, with the remainder of the aggregate placed to the minimum required construction depth.

**3.2.2.3** After placing the drainage aggregate, the geotextile shall be folded over the top of the aggregate in a manner that produces the overlap shown on the plans. In no case shall the minimum overlap be less than 12".

**3.2.3 Separation/Stabilization.** The installation site shall be prepared by clearing, grubbing, and removal of vegetation and topsoil. The site shall be excavated or filled to the proper grade as shown on the plans or as ordered. The Engineer may order that soft spots and unsuitable areas identified during site preparation or subsequent proof rolling be excavated, backfilled, and compacted with suitable materials.

**3.2.3.1** The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade, except that it may be folded or cut to conform to curves. Joints and overlaps shall be in the direction shown on the plans or as ordered by the Engineer. The folds or overlaps shall be held in place by pins, staples, or piles of fill or rock.

**3.2.3.2** Overlying fill or aggregate materials shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed materials. Construction vehicles shall not be allowed directly on the geotextile. Materials shall be placed such that at least the minimum specified lift thickness is between the geotextile and equipment tires or tracks at all times. Turning of vehicles shall not be allowed on the first lift above the geotextile.

**3.2.3.2.1** On very soft subgrades, the fill or aggregate shall be spread to the proper lift thickness as soon as possible after dumping to minimize the potential of localized subgrade failure due to concentrated loading.

**3.2.3.2.2** In stabilization applications, vibratory compaction equipment on the initial lift of fill or aggregate material may be prohibited by the Engineer to prevent damage to the geotextile.

**3.2.3.3** Placement procedures that result in instability or damage to the geotextile shall be modified to eliminate further damage. The Engineer may order remedial measures such as increasing the initial lift thickness or decreasing equipment loads.

**3.2.3.4** Geotextile placed below temporary fills shall be completely removed immediately after the fill is removed. Geotextile salvaged from use under temporary fills shall not be used for any permanent application in the project unless approved by the Engineer.

**3.2.4 Permanent Erosion Control.** The geotextile shall be placed in intimate contact with the soils without wrinkles or folds, and anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement

of the overlying materials will not excessively stretch or tear the geotextile. Anchoring of the terminal ends of the geotextile shall be accomplished through the use of key trenches or aprons at the crest and toe of the slope as shown on the plans.

**3.2.4.1** The geotextile shall be placed with the machine direction (long direction of the roll) parallel to the direction of water flow, which is normally parallel to the slope for erosion control runoff and wave action, and parallel to the stream or channel in the case of stream bank and channel protection. When overlapping, the fabric shall be placed such that the uphill sheet is placed over the downhill sheet, and the upstream sheet is placed over the downstream sheet. In cases where wave action or multidirectional flow is anticipated, all seams perpendicular to the direction of flow shall be sewn.

**3.2.4.2** The armor system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching, puncturing, and tearing of the geotextile. Particles smaller than 1.5 cubic feet, shall be placed with drop heights less than 3 feet. Particles greater than 1.5 cubic feet shall be placed with no free fall. Drop heights exceeding the distance specified above may be allowed by the Engineer if field tests demonstrate that larger drop heights will not result in damage to the fabric. In no case shall stones be rolled or pushed onto the geotextile.

**3.2.4.3** The geotextile and armor materials shall be placed the same day in underwater applications.

**3.2.4.4** Field monitoring shall be performed to verify that the armor system placement does not damage the geotextile. Fabric which is damaged as a result of careless or improper placement of stone, grading techniques, or equipment traffic above the stone shall be repaired or replaced in accordance with 3.3.

**3.3 Repair of Geotextile.** Fabric that is damaged during or after placement shall be replaced or repaired by stitching or patching at the expense of the Contractor. Patches shall be of the same material as the placed geotextile. The patch shall be joined to the existing fabric using overlapped seams as specified above or as directed by the Engineer.

**3.3.1** The Contractor shall modify his placement or covering procedures to eliminate further or repeated damage from occurring.

**3.4 Sewn Seams.** Sewn seams, if specified, ordered, or allowed, shall result in a joint at least as strong as the sewn seam strength requirements described in 2.3. Field or factory seaming will be permitted unless otherwise specified. Sewn seams shall be lapped a minimum of 4" and double sewn using Stitch Type 401 as depicted in ASTM D 6193. Either a "J" seam (Type SSn-2) or "Butterfly" seam (Type SSd-2) shall be used as shown in Figure 1.

**3.4.1** All seams shall be subject to the approval of the Engineer. Sewn seams shall be positioned on the exposed side of the fabric to allow for inspection and/or repair of the fabricated joint. Seams shall not be positioned as shown in Figure 2.

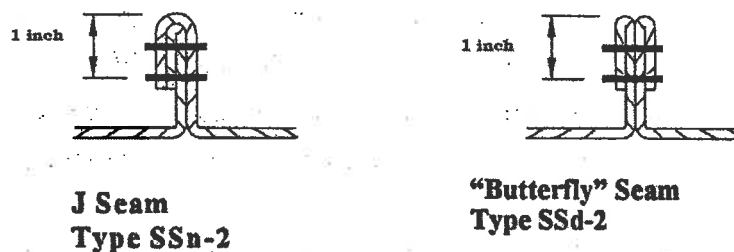
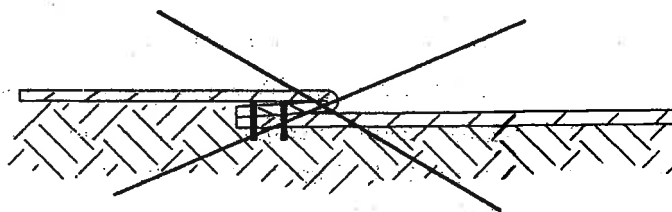


FIGURE 1



**Cannot Inspect or Repair**

**FIGURE 2**

**Method of Measurement**

**4.1** Geotextile will be measured by the square yard as determined by the actual surface measurements of the covered area. Additional material used for overlaps and repairs will not be measured.

**Basis of Payment**

**5.1** The accepted quantity of geotextile will be paid for at the Contract unit price per square yard for the application, strength class, and structure specified, complete in place. The cost of all labor or materials used to anchor, splice, or repair the geotextile is considered subsidiary to the geotextile installation. Removal of temporary geotextile will be considered subsidiary to the geotextile installation.

**Pay Item and Unit:**

593.A B C

Square Yard

**Key:**

**A= Application**

- 1 = Subsurface Drainage
- 2 = Separation
- 3 = Stabilization
- 4 = Permanent Erosion Control

**B = Strength Class**

- 0 = Class 0
- 1 = Class 1
- 2 = Class 2
- 3 = Class 3

**C = Structure**

- 0 = Contractor Option
- 1 = Nonwoven (Default for Application 1 & Application 4)
- 2 = Monofilament, Woven
- 3 = Slit Filament, Woven

Westmoreland - Br. No. 109/124 - NH 63 over Blow-Me-Down Brook

The following is a list of questions that Shane Csiki had Gino Infascelli ask at a meeting held with the Department on June 8, 2017 to discuss bendway weirs. The questions are in bold and responses follow each question.

**Does the current situation look like 2013 with the channel filled with deposited material and will this be removed to reshape the channel?**

The current situation does not look 2013 with the channel filled with deposited material. Based on survey taken in the fall of 2016 the channel seems to have returned to its prior location (as shown on the attached plan). Survey taken in the fall of 2003 (see attached plan) shows the brook eroding the southeast bank and causing scour/undermining of the south east corner of the bridge. In 2003 the snowmobile bridge just upstream of the roadway bridge was undermined and washed downstream. Subsequent flooding events throughout the 2000's continue to cause bank erosion and undermining of the footing. Bendway weirs will be placed to protect the banks as well as to keep the existing thalweg of the channel at its current location.

**Any concern with the weirs being filled with sediment?**

The bendway weirs protecting the banks will and the areas between them should fill up with sediment and material over time to reestablish the southeast bank and maintain the current channel.

**Stone is assumed. Design sizing details?**

Using HEC 23, Design Guideline 14, the design of the stone is Class V, which has a maximum size of 3 feet. A section of a typical bendway is shown on the wetland plans attached.

**Adding stone bank between the weirs? How will these areas be protected?**

The intent is not to add stone along the banks between the bendway weirs. The intent is to use excavated material to stabilize the slopes along with add vegetation as necessary.

**What are the proposed weir heights? Is it a percentage of the average flow of depth?**

Using HEC 23, Design Guideline 1, the proposed weir heights are 1 foot above the streambed. Per section 1.3.1 of the Design Guideline, the bendway weir height should be between 30% to 50% of the depth at the mean annual high water level, the height of the structure should be below the normal or seasonal mean water level and the height of the structure should be equal to or above the mean low water level. Based on the hydraulic information of the site, a 1 foot high bendway weir above the streambed meets all three of these requirements.

**How are they keyed into the channel bottom?**

Figure 1.2 of Design Guideline 1 shows a depth of d100 (min) that the stone should be keyed into the stream bed. The Contractor will remove the existing streambed to this depth and replace it with the Class V stone, which has a maximum size of 3 feet.

**Will the weir ends be just short of the proposed thalweg relocation they intend to achieve?**

Since the weirs are being used for bank protection the weir ends will be short of the current thalweg. However if the channel tries to change due to flooding events (similar to the 2003 survey) the location of the bendway weirs will not allow the thalweg to relocate to the south side of the bank and will shift it back to the center of the brook .

**What is the length and how was the spacing determined?**

The length and spacing were determined using HEC 23, Design Guideline 1. The attached spreadsheet was created using the Bendway Weir Design Example in this section to calculate the dimensions of the weir.

**DESIGN GUIDELINE 1**

**BENDWAY WEIRS/STREAM BARBS**

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## DESIGN GUIDELINE 1

### BENDWAY WEIRS/STREAM BARBS

#### 1.1 INTRODUCTION

Bendway weirs, also referred to as stream barbs, bank barbs, and reverse sills, are low elevation stone sills used to improve lateral stream stability and flow alignment problems at river bends and highway crossings. Bendway weirs are used for improving inadequate navigation channel width at bends on large navigable rivers. They are used more often for bankline protection on streams and smaller rivers. The stream barb concept was first introduced in the Soil Conservation Service (now the Natural Resource Conservation Service, NRCS) by Reichmuth (1993) who has applied these rock structures in many streams in the western United States. The NRCS has recently published design guidance for streambarbs in their National Engineering Handbook (NRCS 2007).

The U.S. Army Corps of Engineers Waterways Experiment Station (WES) developed a physical model to investigate the bendway weir concept in 1988 (USACE 1988, Watson et al. 1996). Since then WES has conducted 11 physical model studies on the use of bendway weirs to improve deep and shallow-draft navigation, align currents through highway bridges, divert sediment, and protect docking facilities. WES has installed bendway weirs to protect eroding banklines on bends of Harland Creek near Tchula, Mississippi. The U.S. Army Corps of Engineers, Omaha District, has used bendway weirs on the Missouri River in eastern Montana. The Missouri River Division (MRD) Mead Hydraulic Laboratory has also conducted significant research and testing of underwater sills. Bendway weirs are a relatively new river training structure and research is providing useful information on their use and effectiveness.

#### 1.2 DESIGN CONCEPT

Bendway weirs are similar in appearance to stone spurs, but have significant functional differences. Spurs are typically visible above the flow line and are designed so that flow is either diverted **around** the structure, or flow along the bank line is reduced as it passes **through** the structure. Bendway weirs are normally not visible, especially at stages above low water, and are intended to redirect flow by utilizing weir hydraulics **over** the structure. Flow passing over the bendway weir is redirected such that it flows perpendicular to the axis of the weir and is directed towards the channel centerline. Similar to stone spurs, bendway weirs reduce near bank velocities, reduce the concentration of currents on the outer bank, and can produce a better alignment of flow through the bend and downstream crossing. **Experience with bendway weirs has indicated that the structures do not perform well in degrading or sediment deficient reaches.**

Bendway weirs have been constructed from stone, tree trunks, and grout filled bags and tubes. Design guidance for bendway weirs has been provided by the U.S. Army Corps of Engineers, Omaha District, WES, and the NRCS. The following geometric design guidelines for stone bendway weirs reflect guidance provided by NRCS (2007), LaGrone (1996), Saele (1994), and Derrick (1994, 1996). The formulas provided by LaGrone were developed to consolidate many of the "rules of thumb" that currently exist in the field. The formulas are not based on exhaustive research, but appear to match well to current practices. Installation examples were provided by Colorado Department of Transportation (CDOT), Washington State Department of Transportation (WSDOT), and Tennessee Department of Transportation (TDOT).

### 1.3 DESIGN GUIDELINES

1. HEIGHT - The height of the weirs,  $H$ , is determined by analyzing various depths of flow at the project site (Refer to Figures 1.1 and 1.2). The bendway weir height should be between 30 to 50% of the depth at the mean annual high water level. The height of the structure should also be below the normal or seasonal mean water level and should be equal to or above the mean low water level. The weir must be of adequate height to intercept a large enough percentage of the flow to produce the desired results. For applications relating to improved navigation width, the weir must be at an elevation low enough to allow normal river traffic to pass over the weir unimpeded.

2. ANGLE - The angle of projection,  $\theta$ , between the bendway weir axis and the upstream bankline tangent typically ranges from 60 to 80 degrees. Experience has indicated that it is easier to measure this angle from the chord between two weirs in the field rather than using the bankline tangent. The chord is drawn from the points of intersection with the weirs and the bankline (Figure 1.1). The angle of projection is determined by the location of the weir in the bend and the angle at which the flow lines approach the structure. Ideally, the angle should be such that the high-flow streamline angle of attack is not greater than 30 degrees and the low-flow streamline angle of attack is not less than 15 degrees to the normal of the weir centerline of the first several weirs. If the angle of flow approaching the upstream weirs is close to head-on, then the weir will be ineffective and act as a flow divider and bank scalloping can result. If the angle of flow approaching the upstream weirs is too large then the weir will not be able to effectively redirect the flow to the desired flow path. Ideally, the angle should be such that the perpendicular line from the midpoint of an upstream weir points to the midpoint of the following downstream weir. All other factors being equal, smaller projection angles,  $\theta$ , would need to be applied to bends with smaller radii of curvature to meet this criteria and vice versa. Experiments by Derrick (1994) resulted in a weir angle,  $\theta$ , of 60 degrees being the most effective for the desired results in a physical model of a reach on the Mississippi River. Observations by LaGrone (1996), indicate that the angle,  $\theta$ , of the upstream face of the structure is most important in redirecting flows. The upstream face should be a well defined straight line at a consistent angle.

3. CROSS SECTION - The transverse slope along the centerline of the weir is intended to be flat or nearly flat and should be no steeper than 1V:5H. The flat weir section normally transitions into the bank on a slope of 1V:1.5H to 1V:2H. The structure height at the bankline should equal the height of the maximum design high water. This level is designed using sound engineering judgment. The key must be high enough to prevent flow from flanking the structure. The bendway weir should also be keyed into the stream bed a minimum depth approximately equal to the  $D_{100}$  size, but also below the anticipated long-term degradation and contraction scour depth.

4. LENGTH - The bendway weir length ( $L$ ) should be long enough to cross the stream thalweg; however, should not exceed  $1/3$  the mean channel width ( $W$ ). A weir length greater than  $1/3$  of the width of the channel can alter the channel patterns which can impact the opposite bankline. Weirs designed for bank protection need not exceed  $1/4$  the channel width. A length of 1.5 to 2 times the distance from the bank to the thalweg has proven satisfactory on some bank stabilization projects. The length of the weir will affect the spacing between the weirs.

$$\text{Maximum Length } L = W/3 \quad (\text{typically: } W/10 < L < W/4) \quad (1.1)$$

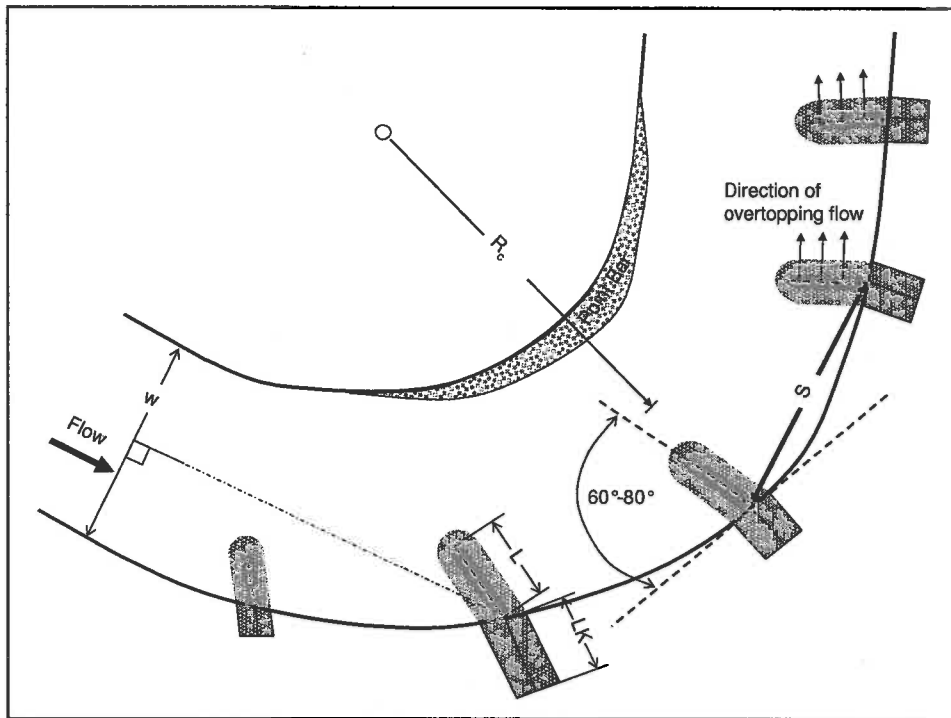


Figure 1.1. Bendway weir typical plan view.

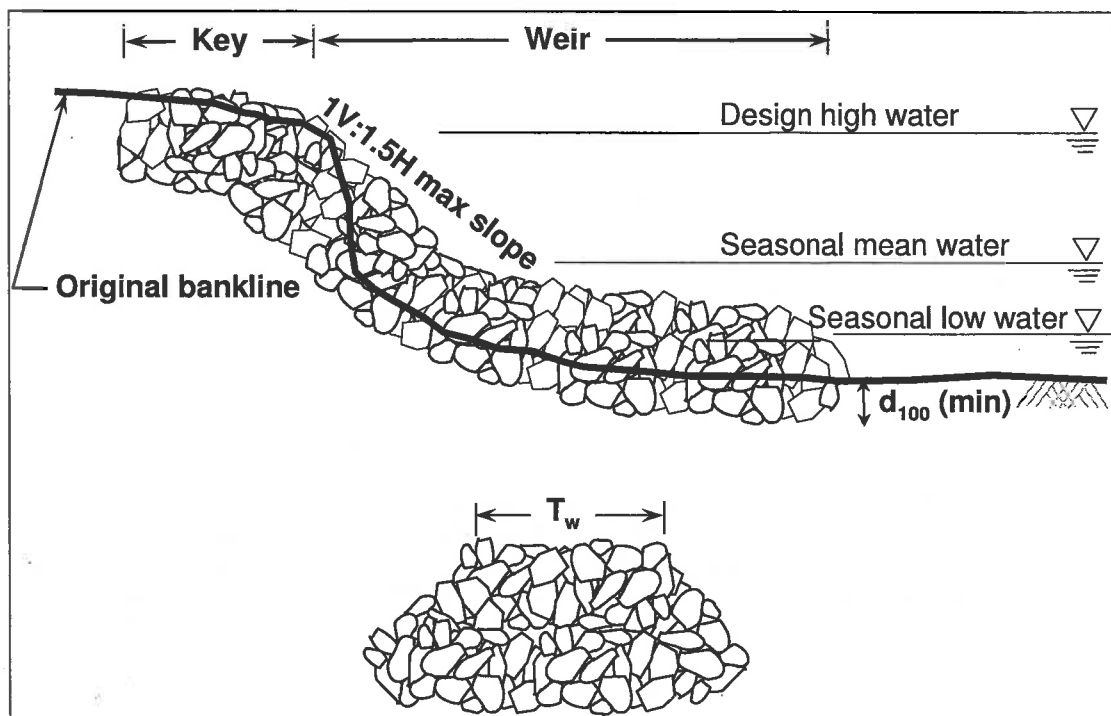


Figure 1.2. Bendway weir typical cross section.

5. LOCATION - Ideally, a short weir should be placed a distance (S) upstream from the location where the midstream tangent flow line (midstream flow line located at the start of the curve) intersects the bankline (PI). Additional bendway weirs are then located based on the site conditions and sound engineering judgment. Typically, the weirs are evenly spaced a distance (S) apart (Figure 1.1).

6. SPACING - Bendway weir spacing is influenced by several site conditions. The following guidance formulas are based on a cursory review of the tests completed by WES on bendway weirs and on tests completed by MRD on underwater sills. Based on the review, bendway weirs should be spaced similarly to hardpoints and spurs. Weir spacing is dependent on the streamflow leaving the weir and its intersection with the downstream structure or bank. Weir spacing (S) is influenced by the length of the weir (L), and the ratios of weir length to channel width (W) and channel radius of curvature (R) to channel width. Spacing can be computed based on the following guidance formulas (USACE 1988, LaGrone 1996):

$$S = 1.5L \left( \frac{R}{W} \right)^{0.8} \left( \frac{L}{W} \right)^{0.3} \quad (1.2)$$

$$S = (4 \text{ to } 5)L \quad (1.3)$$

The spacing selected should fall within the range established by Equations 1.2 and 1.3, depending on bendway geometry and flow alignment. The spacing should not exceed the maximum established by Equation 1.4. Maximum Spacing ( $S_{\max}$ ) is based on the intersection of the tangent flow line with the bankline assuming a simple curve. The maximum spacing is not recommended, but is a reference for designers. In situations where some erosion between weirs can be tolerated, the spacing may be set between the recommended and the maximum.<sup>(4)</sup>

$$S_{\max} = R \left( 1 - \left( 1 - \frac{L}{R} \right)^2 \right)^{0.5} \quad (1.4)$$

Results from the spacing formulas should be investigated to determine if the weir spacing, length, and angle would redirect the flow to the desired location. Streamlines entering and exiting the weirs should be analyzed and drawn in planform.

7. LENGTH OF KEY - Bendway weirs like all bankline protection structures should be keyed into the bankline to prevent flanking by the flow. Typically the key length (LK) is about half the length of the short weirs and about one fifth the length of the long weirs. Tests conducted by MRD found that lateral erosion between spurs on nearly straight reaches could be estimated by using a 20 degree angle of expansion (Figure 1.3). The following guidance formulas for LK were therefore developed. **These formulas compute minimum LK which should be extended in critical locations.** The need for a filter between the weir key and the bank material should also be determined. Guidelines for the selection, design, and specification of filter materials can be found in Holtz et al. (1995) and Design Guideline 16.

When the channel radius of curvature is large ( $R > 5W$ ) and  $S > L/\tan(20^\circ)$

$$LK = S \tan(20^\circ) - L \quad (1.5)$$

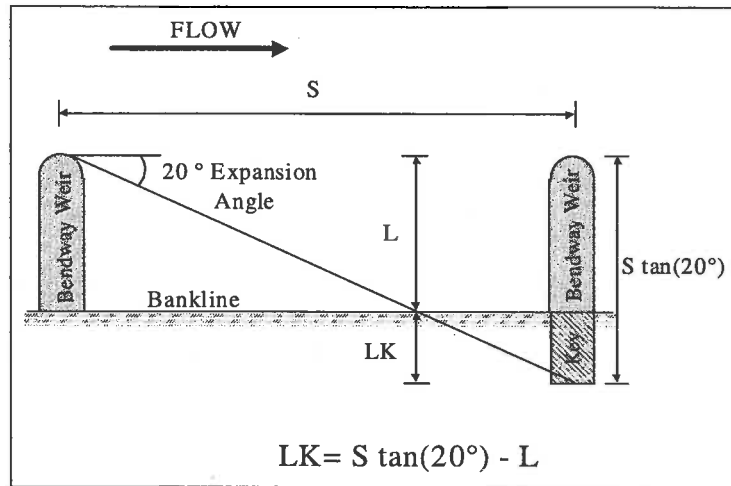


Figure 1.3. Length of key for mild bends.

When the channel radius of curvature is small  $R < 5W$  and  $S < L/\tan(20^\circ)$

$$LK = \frac{L}{2} \left( \frac{W}{L} \right)^{0.3} \left( \frac{S}{R} \right)^{0.5} \quad (1.6)$$

NOTE: LK should not be less than 1.5 times the total bank height.

The NRCS guideline for length of key (LK) for short weirs or barbs (NRCS 2007, Saele 1994) is to key the barb into the bank a minimum distance of 8 ft (2.4 m) or not less than 1.5 times the bank height, which ever is greater.

8. TOP WIDTH - The top width of the weir may vary between 3 and 12 ft (1 m and 4 m), but should be no less than  $(2 \text{ to } 3) \cdot D_{100}$ . Weirs over 30 ft (9 m) in length will have to be built either from a barge or by driving equipment out on the structure during low flows. Structures built by driving equipment on the weir will need to be at least 10 to 15 ft (3 to 5 m) wide. Side slopes of the weirs can be set at the natural angle of repose of the construction material (1V:1.5H) or flatter.

9. NUMBER OF WEIRS - The smallest number of weirs necessary to accomplish the project purpose should be constructed. The length of the weirs and the spacing can be adjusted to meet this requirement. Typically, not less than three weirs are used together on unrevetted banks.

10. CONSTRUCTION - Construction of the bendway weirs are typically conducted during low flow periods for the affected river. Construction methods will vary depending on the size of the river. Construction on larger rivers may be conducted using a barge which would allow the rock to be placed without disturbing the bankline. For rivers where a barge is not available and where the bendway weir is longer than 30 ft (9 m), access will need to be made from the bank and equipment may need to be driven out on the weir as it is being constructed.

Supplemental information on the use of bendway weirs on tight bends (small radius of curvature) and complex meanders can be found in LaGrone (1996).

#### 1.4 MATERIAL SPECIFICATIONS

1. Stone should be angular, and not more than 30% of the stone should have a length exceeding 2.5 its thickness.
2. No stone should be longer than 3.5 times its thickness.
3. Stone should be well graded but with only a limited amount of material less than half the median stone size. Since the stone will most often be placed in moving water, the smaller stone will be subject to displacement by the flow during installation.
4. Construction material should be quarry run stone or broken, clean concrete. High quality material is recommended for long-term performance.
5. Material sizing should be based on standard riprap sizing formulas for turbulent flow. Typically the size should be approximately 20% greater than that computed from nonturbulent riprap sizing formulas. The riprap  $D_{50}$  typically ranges between 1 and 3 ft (300 mm and 910 mm) and should be in the 100 to 1,000 lb (45 kg to 450 kg) range. The  $D_{100}$  rock size should be at least 3 times the calculated  $D_{50}$  size. The minimum rock size should not be less than the  $D_{100}$  of the streambed material.
6. Guidelines for the selection, design, and specification of filter materials can be found in Holtz et al. (1995) and Design Guideline 16.

#### 1.5 BENDWAY WEIR DESIGN EXAMPLE

The following example illustrates the preliminary layout of bendway weirs for use in bank protection at a stream bend. The design uses guidelines provided in the previous sections.

##### Given:

The stream width is 100 ft (30 m). The radius of the bend is 500 ft (152 m). The bank height is 10 ft (3 m), which is the mean annual high water level.

Develop a preliminary layout for bendway weir placement for bank protection at the stream bend. The preliminary layout should include weir height, weir length, key length, and weir spacing. Assume the stone size will be established in the final design of the system.

##### Step 1: Determine the weir height.

$H = 0.3$  to  $0.5$  of mean annual high water depth (use  $0.3$  for this problem)

$$H = 0.3 (10 \text{ ft}) = 3 \text{ ft (0.9 m)}$$

##### Step 2: Determine the weir length.

$$L = W/3 \text{ for flow redirection}$$

$$L = W/4 \text{ for bank protection}$$

$$L = 100 \text{ ft}/4 = 25 \text{ ft (7.5 m)}$$

**Step 3: Determine the weir spacing.**

$$S = 1.5L \left[ \frac{R}{W} \right]^{0.8} \left[ \frac{L}{W} \right]^{0.3}$$

$$S = 1.5(25) \left[ \frac{500}{100} \right]^{0.8} \left[ \frac{25}{100} \right]^{0.3} = 90 \text{ ft (27.2m)}$$

Check against  $S = 4(L) = 4(25 \text{ ft}) = 100 \text{ ft (30 m)}$ . Based on site conditions, use 100 ft (30 m).

Check against the maximum spacing, given by:

$$S_{\max} = R \left[ 1 - \left[ 1 - \frac{L}{R} \right]^2 \right]^{0.5}$$

$$S_{\max} = 500 \left[ 1 - \left[ 1 - \frac{25}{500} \right]^2 \right]^{0.5} = 156 \text{ ft (47.2m)}$$

$S_{\max} > S$ , continue:

**Step 4: Determine the key length.**

Check for  $R > 5W$  and  $S > L/\tan(20^\circ)$

$R = 500 \text{ ft (152 m)}$  and  $W = 100 \text{ ft (30 m)}$ , therefore  $R > 5(W) = 500 \text{ ft (152 m)}$

$S = 100 \text{ ft (30 m)}$  and  $L = 25 \text{ ft (7.5 m)}$ , therefore  $S > L/\tan(20^\circ) = 68.7 \text{ ft (20.6 m)}$

$$LK = S \tan(20^\circ) - L$$

$$LK = 100 \tan(20^\circ) - 25 = 11.4 \text{ ft (3.4 m)}$$

Check against  $LK \geq 1.5(\text{Bank Height}) = 1.5(10) = 15 \text{ ft (4.5 m)}$

LK must be set to 15 ft (4.5 m) because this value is greater than the value computed first.

**Step 5: Preliminary Layout.**

The preliminary layout for this stream bend as follows:

Height	$H = 3 \text{ ft (0.9 m)}$
Length	$L = 25 \text{ ft (7.5 m)}$
Spacing	$S = 100 \text{ ft (30 m)}$
Length of key	$LK = 15 \text{ ft (4.5 m)}$

## 1.6 INSTALLATION EXAMPLES

Some illustrations of bendway weirs in use are shown in Figures 1.4 - 1.7. Figures 1.4 and 1.5 show short bendway weirs shortly after installation by CDOT on the Blue River near Silverthorne, Colorado in February 1997. These weirs were designed with weir lengths of 11.5 – 20 ft (3.5 - 6 m) at  $\theta$  angles of  $75^\circ$  to the bankline tangent. The CDOT engineer indicated that adjustments in the field are equally as important and necessary as original design plans. It can be observed that the bendway weirs are being constructed at low flow conditions as discussed previously.

Figures 1.6 and 1.7 show bendway weirs installed by WSDOT on the Yakima River, Washington in 1994. Figure 1.6 shows the weirs at low flow conditions and Figure 1.7 shows the submerged weirs at normal to high flow conditions. Surface disturbances as flow passes over the weirs can be observed in Figure 1.7. These weirs were designed at  $\theta$  angles of  $50^\circ$  to the bankline tangent to direct flow away from a critical pier at a bridge just downstream of this bend.

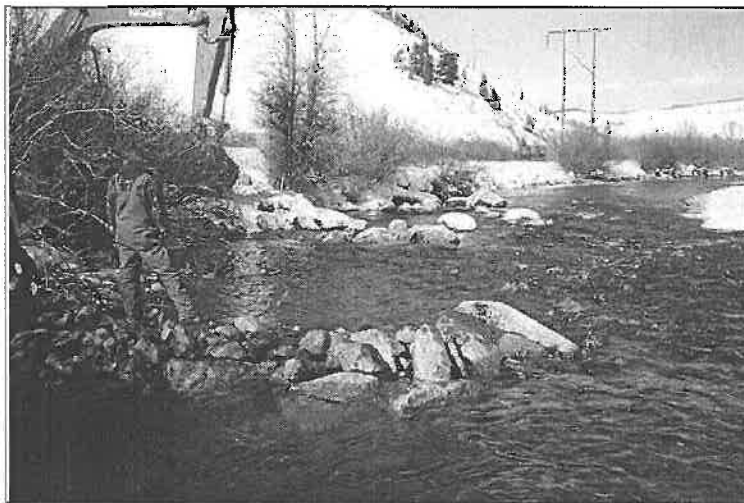


Figure 1.4. Bendway weirs installed on the Blue River near Silverthorne, Colorado (CDOT).

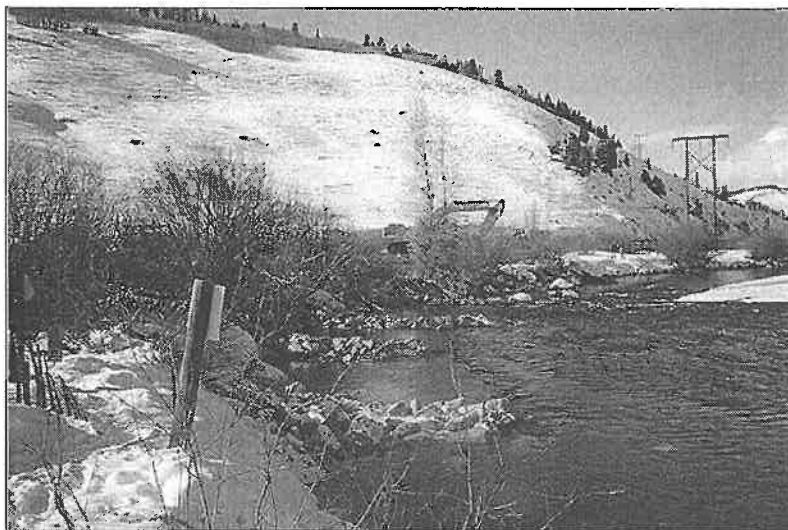


Figure 1.5. Bendway weirs installed on the Blue River near Silverthorne, Colorado (CDOT).

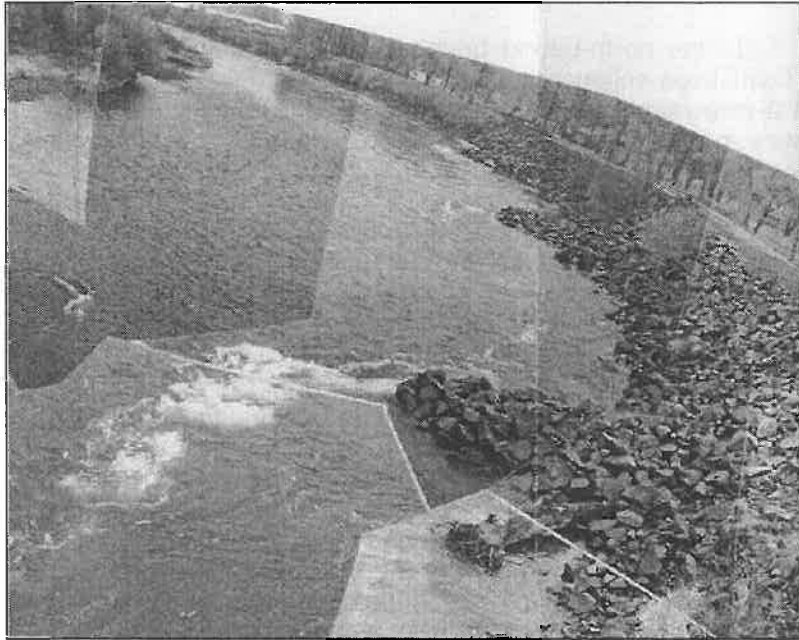


Figure 1.6. Bendway weirs on the Yakima River, Washington at low flow (WSDOT).

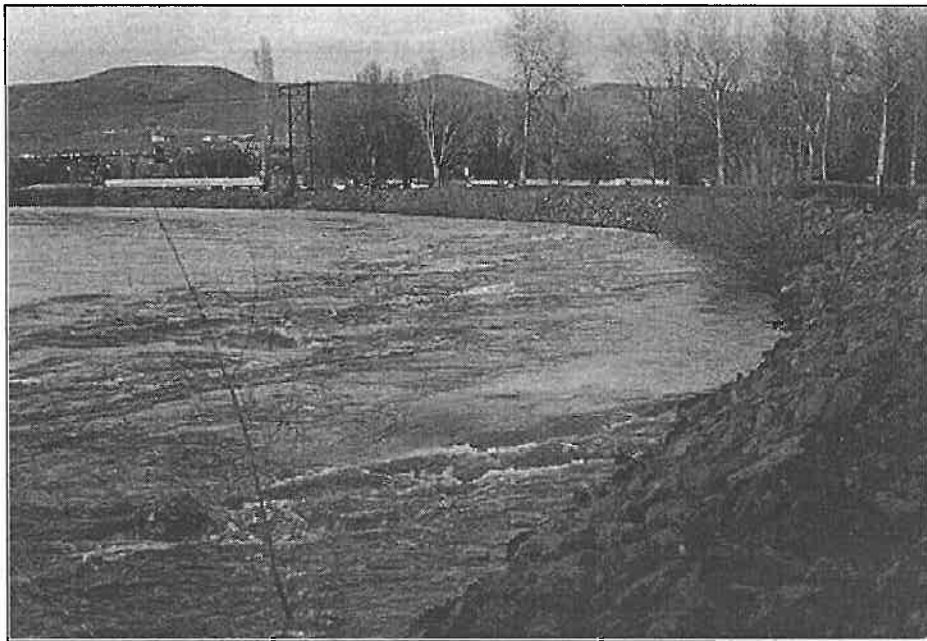


Figure 1.7. Submerged bendway weirs on the Yakima River, Washington at high flow (WSDOT).

## 1.7 CASE STUDY - BENDWAY WEIRS ON THE HATCHIE RIVER, TENNESSEE

On April 1, 1989 the north-bound bridge of U.S. Route 51 over the Hatchie River near Covington, Tennessee collapsed with the loss of eight lives. The flow was 8,620 cfs (244 m<sup>3</sup>/s) with a 2-year return period. However, the U.S. Geological Survey estimated that this 1989 flow was in the top 10 for overbank flow duration and the longest overbank flow duration since 1974 (Bryan 1989).

The foundation of the bridge consisted of pile bents on the floodplain and piers in the channel. The bents were supported on 20 ft (6.1 m) long timber piles embedded 1 ft (0.3 m) into concrete pile caps. The bottom of the pile caps for the floodplain bents was at an elevation 13 to 14 ft (4 to 4.3 m) higher than for the piers (Figure 1.8). The floodplain and river channel were erodible silt, sand, and clay. The north bound bridge was built in 1936 and spanned 4,000 ft (1,219 m) of the floodplain on 143 simple spans. The south bound bridge was built in 1974 and narrowed the bridge opening to 1,000 ft (305 m) on 13 spans.

The bridges spanned the Hatchie River on a meander bend. Bend migration to the north was well documented. From 1931 to 1975 the migration rate averaged 0.8 ft (0.24 m) per year; 1975 to 1981 (after the south bound bridge was built) was 4.5 ft (1.37 m) per year; and 1981 to 1989 was 1.9 ft (0.58 m) per year (Figure 1.8). The migration was such that in 1989 bent 70 was exposed to the flow. The combination of channel migration and local pier scour caused the bent to fail.

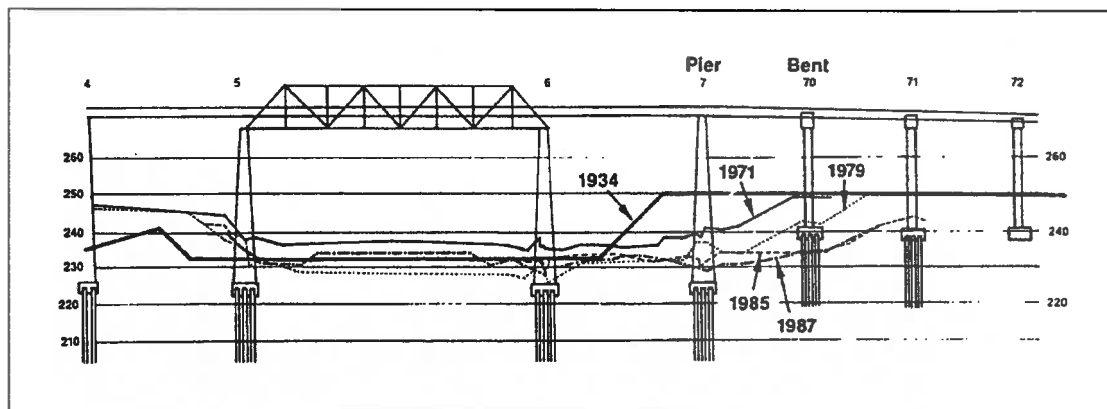


Figure 1.8. Documented channel migration of the Hatchie River, Tennessee.

The National Transportation Safety Board (NTSB 1990) investigated the failure and gave as probable cause "...the northward migration of the main river channel which the Tennessee Department of Transportation failed to evaluate and correct. Contributing to the severity of the accident was the lack of redundancy in the design of the bridge spans."

After the failure of the Hatchie River bridge, TDOT experienced additional instability on the north bank of the river, upstream from the replacement bridge. The solution was to design and install bendway weirs along the north bank (Peck 1999). A field of five bendway weirs was designed to halt the bank erosion. Design parameters were estimated using guidance from HEC-23 (First Edition). As part of the design process, a 2-dimensional hydraulic model was utilized. The model provided flow field data to refine and verify the bendway weir design. Construction was initiated and completed in the Fall of 1999. Figures 1.9 and 1.10 show the installed countermeasures at low flow.

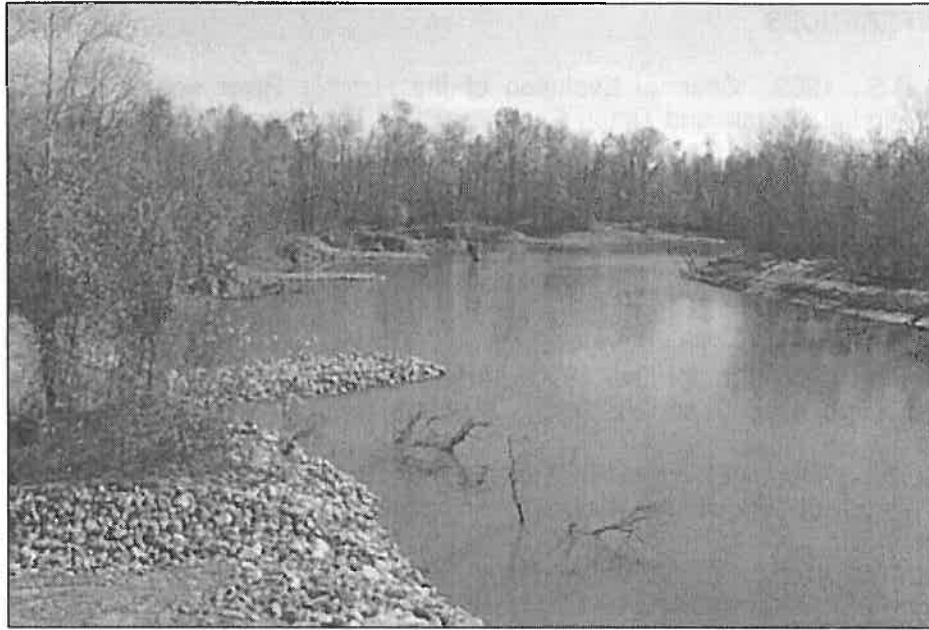


Figure 1.9. Bendway weirs on northbank of Hatchie River looking upstream (TDOT).



Figure 1.10. Close up bendway weir on Hatchie River (TDOT).

## 1.8 REFERENCES

- Bryan, B.S., 1989, "Channel Evolution of the Hatchie River near the U.S. Highway 51 Crossing in Lauderdale and Tipton Counties, West Tennessee," USGS Open-File Report 89-598, Nashville, TN.
- Derrick, D.L., 1994, "Design and Development of Bendway Weirs for the Dogtooth Bend Reach, Mississippi River, Hydraulic Model Investigation," Technical Report HL-94-10, WES, Vicksburg, MS.
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- Watson, C.C., Gessler, D., Abt, S.R., Thornton, C.I., and Kozinski, P., 1996, "Demonstration Erosion Control Monitoring Sites, 1995 Evaluation," Annual Report DACW39-92-K-0003, Colorado State University, Fort Collins, CO.

## BENDWAY WEIR DESIGN

Stream Width =  feet (from Microstation)

Bend Radius =  feet (from Microstation)

Bank Height =  feet (from Microstation)

### Step 1 Determine the weir height

#### HEC 23 Section 1.3 Design Guideline

The bendway weir height should be between 30% to 50% of the depth at the mean annual high water level (Q100).

The height of the structure should be below the normal or seasonal mean water level (Q2?)

The height of the structure should be equal to or above the mean low water level (Q??)

Elevation of design high water level =

Elevation of seasonal mean water level =

Elevation of seasonal low water level =

Elevation of streambed =

Design high water depth = 3.3

Seasonal mean water depth = 1.8

Seasonal low water depth = 0

Use weir height = 30% = 0.99 50% = 1.65

Below seasonal mean water level? OK OK

Above seasonal low water level? OK OK

Use weir height =  Input which height to use

### Step 2 Determine the weir length

$L = W/3$  for flow redirection  $L = 32$

$L = W/4$  for bank protection 24

Use length =  Input which length to use

### Step 3 Determine the weir spacing

$S = (1.5 * L) * ((R/W)^{0.8}) * ((L/W)^{0.3})$  50

$$S = 4*L \text{ to } 5*L \quad 128 \quad 160$$

$$S_{\max} = R * ((1 - ((1 - L/R)^2))^{0.5}) \quad 93$$

Use spacing =  Input which spacing to use

#### Step 4 Determine the key length

$$R > 5W \quad 150 > \quad 475 \quad \text{NOT OK}$$

$$S > L/\tan(20) \quad 50 > \quad 88 \quad \text{NOT OK}$$

$$LK = (S * \tan(20)) - L \quad LK = \quad -14$$

$$R < 5W \quad 150 < \quad 475 \quad \text{OK}$$

$$S < L/\tan(20) \quad 50 < \quad 88 \quad \text{OK}$$

$$LK = (L/2) * ((W/L)^{0.3}) * ((S/R)^{0.5}) \quad LK = \quad 13$$

$$LK = \min \text{ of } 8' \quad 8 \text{ feet}$$

$$LK = 1.5 * \text{Bank Height} \quad 9 \text{ feet}$$

Use key length =  Input which key length to use

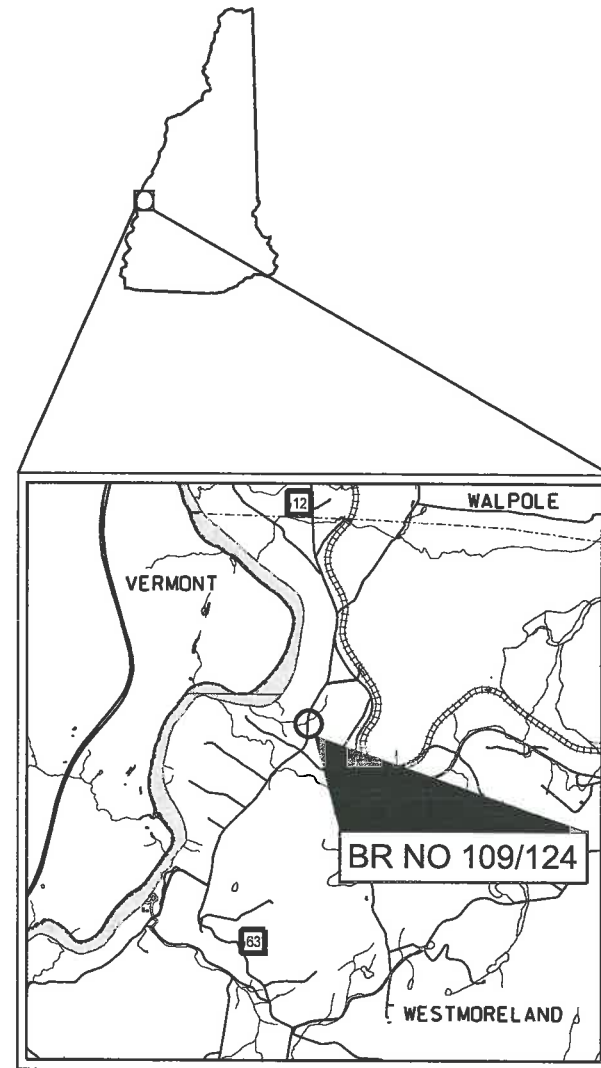
#### Step 5 Preliminary Layout

The preliminary layout for this stream bend is as follows:

$$\begin{aligned} \text{Height} &= 1 \\ \text{Length} &= 32 \\ \text{Spacing} &= 50 \\ \text{Length of key} &= 13 \end{aligned}$$

STATE OF NEW HAMPSHIRE  
DEPARTMENT OF TRANSPORTATION  
**WETLANDS PLANS**  
**FEDERAL AID PROJECT**

N.H. PROJECT NO. 27287  
NH ROUTE 63

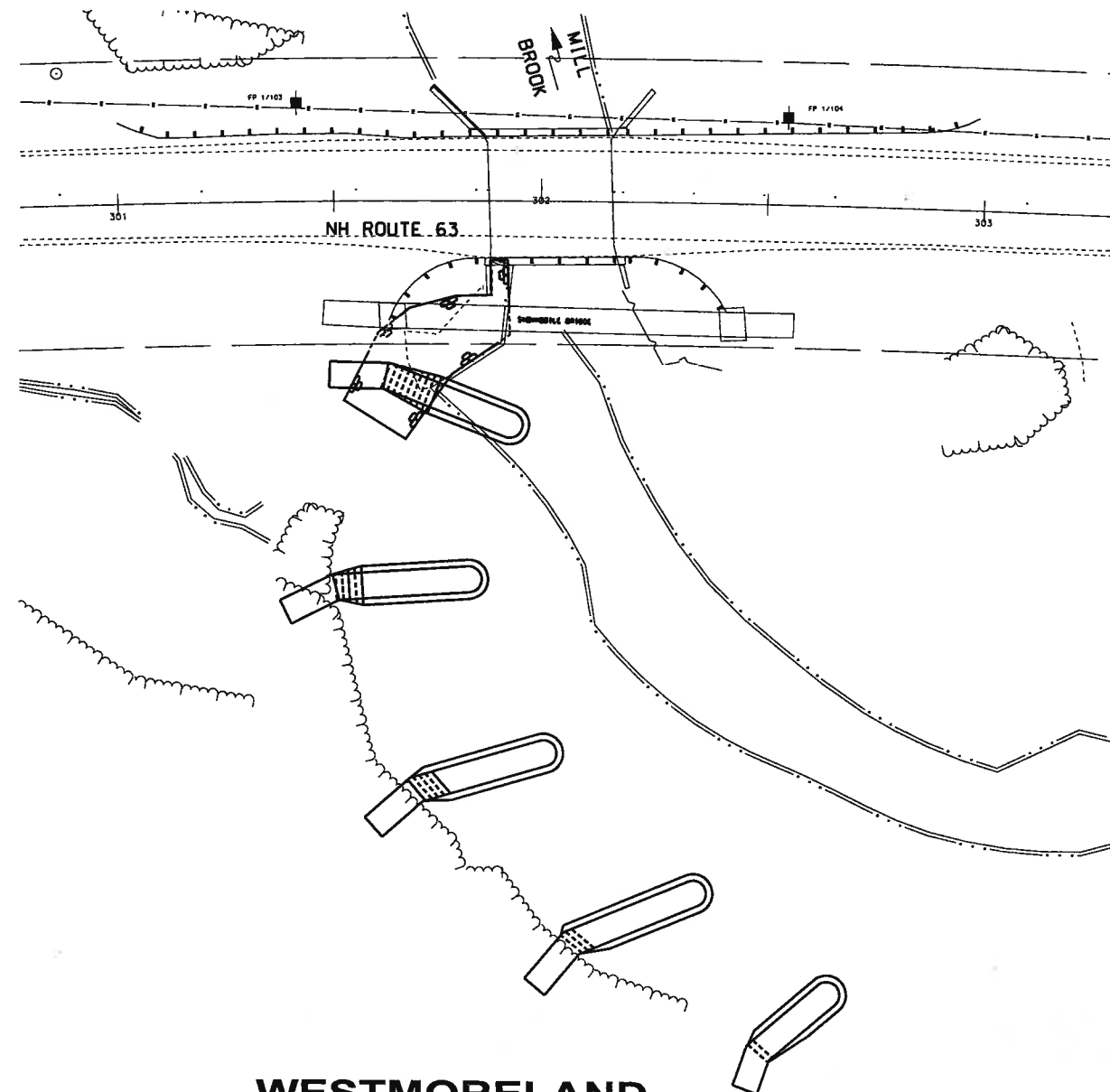


LOCATION MAP



INDEX OF SHEETS

- 1 FRONT SHEET
- 2-3 STANDARD SYMBOLS SHEETS
- 4 WETLAND IMPACT PLAN
- 5 EROSION CONTROL STRATEGIES
- 6 EROSION CONTROL PLAN
- 7 WESTMORELAND BR NO 109/124



**WESTMORELAND**  
CHESHIRE COUNTY

SCALE: 1" = 10'-0"

FOR CONSTRUCTION AND ALIGNMENT DETAILS - SEE CONSTRUCTION PLANS

**NHDOT** THE STATE OF  
NEW HAMPSHIRE  
DEPARTMENT OF  
TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER DATE

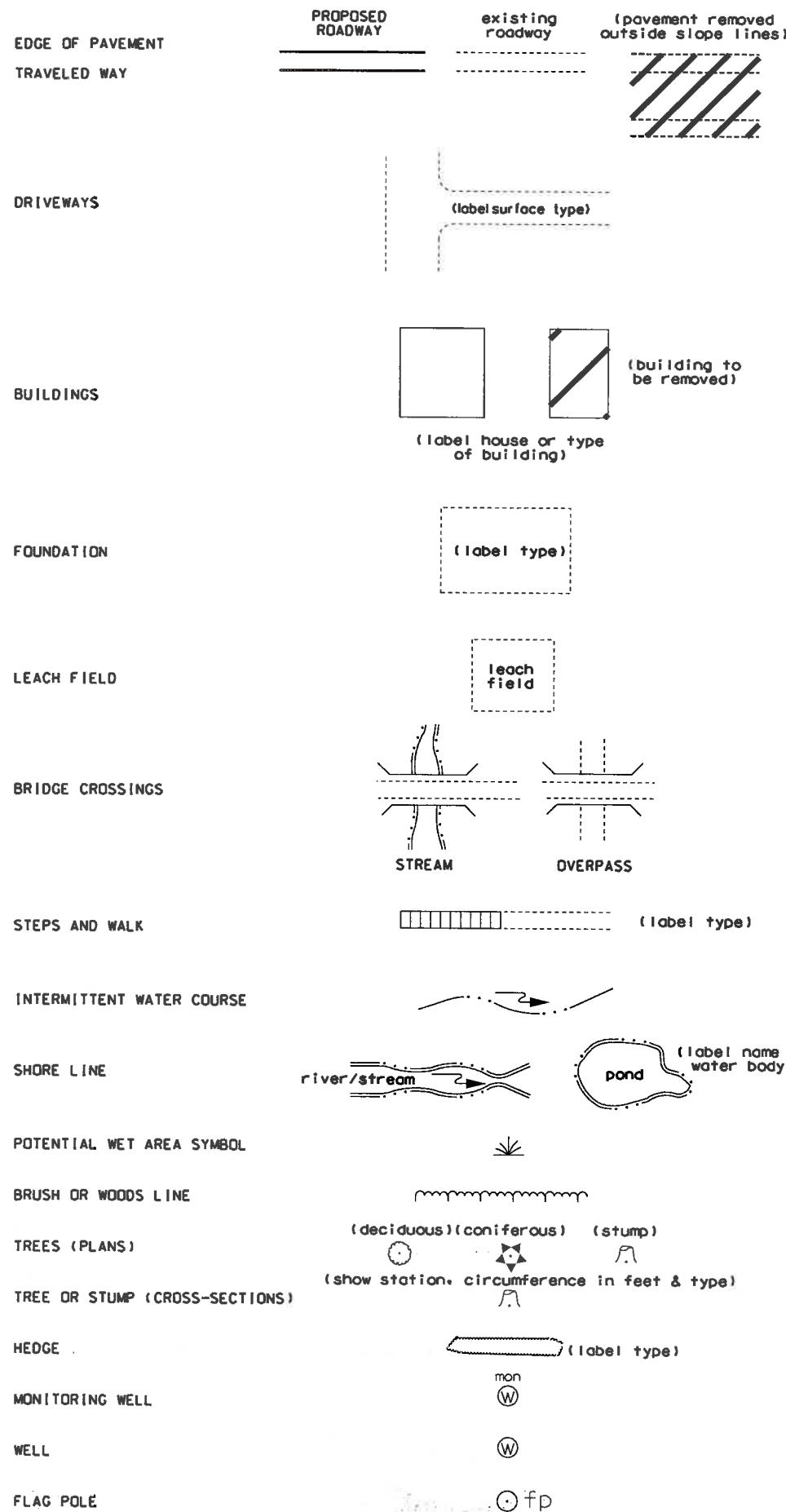
U. S. DEPARTMENT OF  
TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

APPROVED:

DIVISION ADMINISTRATOR DATE

FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
	27287	1	7

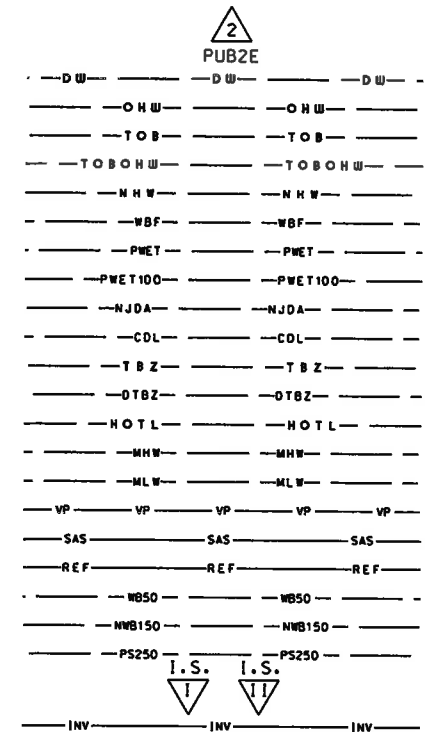
## GENERAL



## SHORELAND - WETLAND

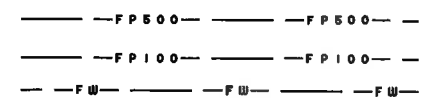
### WETLAND DESIGNATION AND TYPE

DELINEATED WETLAND  
ORDINARY HIGH WATER  
TOP OF BANK  
TOP OF BANK & ORDINARY HIGH WATER  
NORMAL HIGH WATER  
WIDTH AT BANK FULL  
PRIME WETLAND  
PRIME WETLAND 100' BUFFER  
NON-JURISDICTIONAL DRAINAGE AREA  
COWARDIN DISTINCTION LINE  
TIDAL BUFFER ZONE  
DEVELOPED TIDAL BUFFER ZONE  
HIGHEST OBSERVABLE TIDE LINE  
MEAN HIGH WATER  
MEAN LOW WATER  
VERNAL POOL  
SPECIAL AQUATIC SITE  
REFERENCE LINE  
WATER FRONT BUFFER  
NATURAL WOODLAND BUFFER  
PROTECTED SHORELAND  
INVASIVE SPECIES LABEL



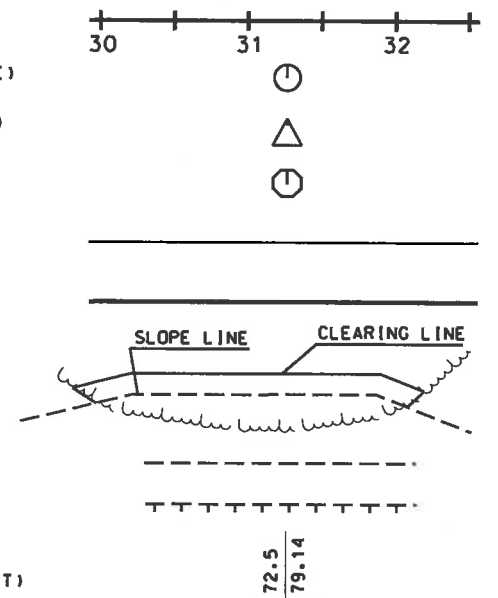
## FLOODPLAIN / FLOODWAY

500 YEAR FLOODPLAIN BOUNDARY  
100 YEAR FLOODPLAIN BOUNDARY  
FLOODWAY



## ENGINEERING

CONSTRUCTION BASELINE  
PC, PT, POT (ON CONST BASELINE)  
PI (IN CONSTRUCTION BASELINES)  
INTERSECTION OR EQUATION OF TWO LINES  
ORIGINAL GROUND LINE (PROFILES AND CROSS-SECTIONS)  
PROFILE GRADE LINE (PROFILES AND CROSS-SECTIONS)  
CLEARING LINE  
SLOPE LINE  
SLOPE LINE (FILL)  
SLOPE LINE (CUT)  
PROFILES AND CROSS SECTIONS:  
ORIGINAL GROUND ELEVATION (LEFT)  
FINISHED GRADE ELEVATION (RIGHT)



SHEET 1 OF 2

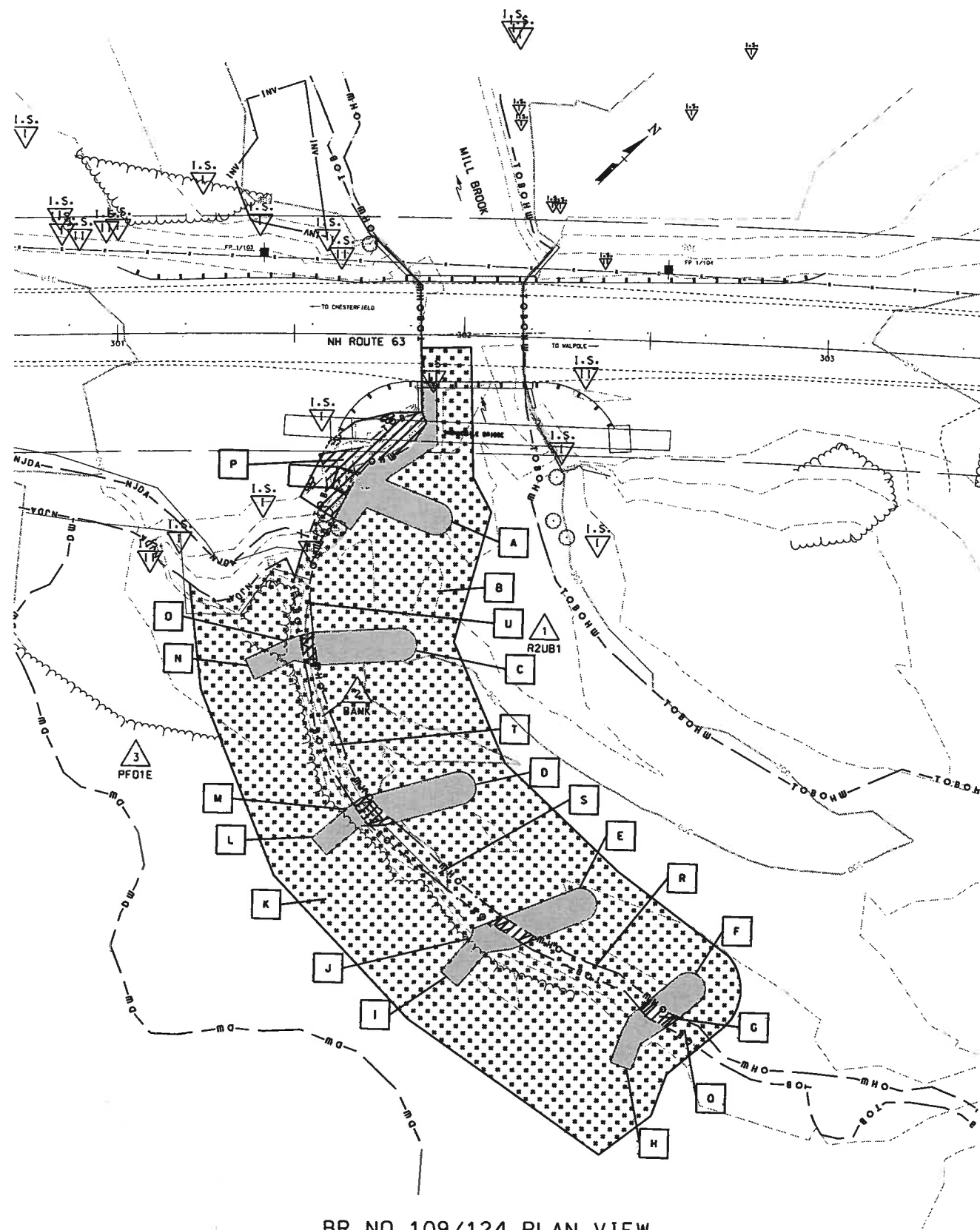
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
11-21-2014	stdsyml_2	27287	2	7





BR NO 109/124 PLAN VIEW

SCALE: 1" = 20'-0"  
HALF SIZE SCALE: 1" = 40'-0"



SCALE IN FEET

WETLAND DELINEATION BY CHRISTOPHER C. DORION, CERTIFIED WETLAND SCIENTIST NO. 251,  
OF C.C. DORION GEOLOGICAL SERVICES, LLC. DELINEATION OCCURED ON DECEMBER 1 AND 2, 2016.

## LEGEND

TYPE OF WETLAND IMPACT	SHADING/HATCHING	#	WETLAND DESIGNATION NUMBER
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	[Diagonal lines]	#	WETLAND IMPACT LOCATION
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	[Solid grey]	#	WETLAND MITIGATION AREA
TEMPORARY IMPACTS	[Dotted]	[Diagonal lines]	MITIGATION

WETLAND IMPACT SUMMARY											
WETLAND NUMBER	WETLAND CLASSIFICATION	LOCATION	AREA IMPACTS						LINEAR STREAM IMPACTS FOR MITIGATION		
			PERMANENT			TEMPORARY			PERMANENT		
			N.H.W.B. (NON-WETLAND)		N.H.W.B. & A.C.O.E. (WETLAND)				BANK LEFT	BANK RIGHT	CHANNEL
			SF	LF	SF	LF	SF	LF			
1	R2UB1	A	-	-	450	48	-	-	-	-	48
1	R2UB1	B	-	-	-	-	5931	206	-	-	-
1	R2UB1	C	-	-	248	9	-	-	-	-	9
1	R2UB1	D	-	-	238	9	-	-	-	-	9
1	R2UB1	E	-	-	196	9	-	-	-	-	9
1	R2UB1	F	-	-	113	9	-	-	-	-	9
2	BANK	G	40	9	-	-	-	-	9	-	-
3	PFD1E	H	-	-	110	9	-	-	9	-	-
3	PFD1E	I	-	-	145	9	-	-	9	-	-
2	BANK	J	38	9	-	-	-	-	9	-	-
3	PFD1E	K	-	-	-	-	5967	187	-	-	-
3	PFD1E	L	-	-	89	9	-	-	9	-	-
2	BANK	M	50	9	-	-	-	-	9	-	-
3	PFD1E	N	-	-	98	9	-	-	9	-	-
2	BANK	O	31	9	-	-	-	-	9	-	-
2	BANK	P	284	40	-	-	-	-	40	-	-
2	BANK	Q	-	-	-	-	48	13	-	-	-
2	BANK	R	-	-	-	-	128	37	-	-	-
2	BANK	S	-	-	-	-	181	41	-	-	-
2	BANK	T	-	-	-	-	186	40	-	-	-
2	BANK	U	-	-	-	-	148	35	-	-	-
TOTAL			443	76	1687	120	12589	559	112	-	84

PERMANENT IMPACTS: 2130 SF  
TEMPORARY IMPACTS: 12589 SF  
TOTAL IMPACTS: 14719 SF

## WETLAND CLASSIFICATION CODES

R2UB1	RIVERINE LOWER PERENNIAL UNCONSOLIDATED BOTTOM COBBLE-GRAVEL
BANK	BANK
PFD1E	PALUSTRINE FORESTED BROAD-LEAVED DECIDUOUS SEASONALLY FLOODED/SATURATED
NJDA	NONJURISDICTIONAL DRAINAGE AREA

STATE OF NEW HAMPSHIRE  
DEPARTMENT OF TRANSPORTATION \* BUREAU OF BRIDGE DESIGN  
TOWN WESTMORELAND BRIDGE NO. 109/124 STATE PROJECT 27287  
LOCATION NH RTE 63 over MILL BROOK

## WETLAND IMPACT PLAN BR NO 109/124

REVISIONS AFTER PROPOSAL				BY		DATE		BY		DATE		--- OF ---		
DESIGNED				JAT		4/17		CHECKED		BOEnv		4/17		FILE NUMBER
DRAWN				SMG		4/17		CHECKED		JAT		4/17		
QUANTITIES				SMG		4/17		CHECKED		JAT		4/17		
ISSUE DATE				FEDERAL PROJECT NO.				SHEET NO.				TOTAL SHEETS		
REV DATE				-----				4				7		

SUBDIRECTORY	DGN	LOCATOR	SHEET SCALE
BRIDGE CONTRACT #1	109/124	AR NOTED	

# EROSION CONTROL STRATEGIES

## 1. ENVIRONMENTAL COMMITMENTS:

- 1.1. THESE GUIDELINES DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH ANY CONTRACT PROVISIONS, OR APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.
- 1.2. THIS PROJECT WILL BE SUBJECT TO THE US EPA'S NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER CONSTRUCTION GENERAL PERMIT AS ADMINISTERED BY THE ENVIRONMENTAL PROTECTION AGENCY (EPA). THIS PROJECT IS SUBJECT TO REQUIREMENTS IN THE MOST RECENT CONSTRUCTION GENERAL PERMIT (CGP).
- 1.3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE NHDES WETLAND PERMIT, THE US ARMY CORPS OF ENGINEERS PERMIT, WATER QUALITY CERTIFICATION AND THE SPECIAL ATTENTION ITEMS INCLUDED IN THE CONTRACT DOCUMENTS.
- 1.4. ALL STORM WATER, EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE NEW HAMPSHIRE STORMWATER MANUAL, VOLUME 3, EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION (DECEMBER 2008) (BMP MANUAL) AVAILABLE FROM THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES).
- 1.5. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17, AND ALL, PUBLISHED NHDES ALTERATION OF TERRAIN ENV-WO 1500 REQUIREMENTS ([HTTP://DES.NH.GOV/ORGANIZATION/COMMISSIONER/LEGAL/RULES/INDEX.HTM](http://DES.NH.GOV/ORGANIZATION/COMMISSIONER/LEGAL/RULES/INDEX.HTM))
- 1.6. THE CONTRACTOR IS DIRECTED TO REVIEW AND COMPLY WITH SECTION 107.1 OF THE CONTRACT AS IT REFERS TO SPILLAGE, AND ALSO WITH REGARDS TO EROSION, POLLUTION, AND TURBIDITY PRECAUTIONS.

## 2. STANDARD EROSION CONTROL SEQUENCING APPLICABLE TO ALL CONSTRUCTION PROJECTS:

- 2.1. PERIMETER CONTROLS SHALL BE INSTALLED PRIOR TO EARTH DISTURBING ACTIVITIES. PERIMETER CONTROLS AND STABILIZED CONSTRUCTION EXITS SHALL BE INSTALLED AS SHOWN IN THE BMP MANUAL AND AS DIRECTED BY THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARER.
- 2.2. EROSION, SEDIMENTATION CONTROL MEASURES AND INFILTRATION BASINS SHALL BE CLEANED, REPLACED AND AUGMENTED AS NECESSARY TO PREVENT SEDIMENTATION BEYOND PROJECT LIMITS THROUGHOUT THE PROJECT DURATION.
- 2.3. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED IN ACCORDANCE WITH THE CONSTRUCTION GENERAL PERMIT AND SECTION 645 OF THE NHDOT SPECIFICATIONS FOR ROAD AND BRIDGES CONSTRUCTION.
- 2.4. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
  - (A) BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED;
  - (B) A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
  - (C) A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIP-RAP HAS BEEN INSTALLED;
  - (D) TEMPORARY SLOPE STABILIZATION CONFORMING TO TABLE 1 HAS BEEN PROPERLY INSTALLED
- 2.5. ALL STOCKPILES SHALL BE CONTAINED WITH A PERIMETER CONTROL. IF THE STOCKPILE IS TO REMAIN UNDISTURBED FOR MORE THAN 14 DAYS, MULCHING WILL BE REQUIRED.
- 2.6. A WATER TRUCK SHALL BE AVAILABLE TO CONTROL EXCESSIVE DUST AT THE DIRECTION OF THE CONTRACT ADMINISTRATOR.
- 2.7. TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL REMAIN UNTIL THE AREA HAS BEEN PERMANENTLY STABILIZED.
- 2.8. CONSTRUCTION PERFORMED ANY TIME BETWEEN NOVEMBER 30<sup>th</sup> AND MAY 1<sup>st</sup> OF ANY YEAR SHALL BE CONSIDERED WINTER CONSTRUCTION AND SHALL CONFORM TO THE FOLLOWING REQUIREMENTS.
  - (A) ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15<sup>th</sup>, OR WHICH ARE DISTURBED AFTER OCTOBER 15<sup>th</sup>, SHALL BE STABILIZED IN ACCORDANCE WITH TABLE 1.
  - (B) ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15<sup>th</sup>, OR WHICH ARE DISTURBED AFTER OCTOBER 15<sup>th</sup>, SHALL BE STABILIZED TEMPORARILY WITH STONE OR IN ACCORDANCE WITH TABLE 1.
  - (C) AFTER NOVEMBER 30<sup>th</sup> INCOMPLETE ROAD SURFACES, WHERE WORK HAS STOPPED FOR THE SEASON, SHALL BE PROTECTED IN ACCORDANCE WITH TABLE 1.
  - (D) WINTER EXCAVATION AND EARTHWORK SHALL BE DONE SUCH THAT NO MORE THAN 1 ACRE OF THE PROJECT IS WITHOUT STABILIZATION AT ONE TIME, UNLESS A WINTER CONSTRUCTION PLAN HAS BEEN APPROVED BY NHDOT THAT MEETS THE REQUIREMENTS OF ENV-WO 1505.02 AND ENV-WO 1505.05.
  - (E) A SWPPP AMENDMENT SHALL BE SUBMITTED TO THE DEPARTMENT, FOR APPROVAL, ADDRESSING COLD WEATHER STABILIZATION (ENV-WO 1505.05) AND INCLUDING THE REQUIREMENTS OF NO LESS THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF WORK SCHEDULED AFTER NOVEMBER 30<sup>th</sup>.

## GENERAL CONSTRUCTION PLANNING AND SELECTION OF STRATEGIES TO CONTROL EROSION AND SEDIMENT ON HIGHWAY CONSTRUCTION PROJECTS

### 3. PLAN ACTIVITIES TO ACCOUNT FOR SENSITIVE SITE CONDITIONS:

- 3.1. CLEARLY FLAG AREAS TO BE PROTECTED IN THE FIELD AND PROVIDE CONSTRUCTION BARRIERS TO PREVENT TRAFFICKING OUTSIDE OF WORK AREAS.
- 3.2. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS.
- 3.3. PROTECT AND MAXIMIZE EXISTING NATIVE VEGETATION AND NATURAL FOREST BUFFERS BETWEEN CONSTRUCTION ACTIVITY AND SENSITIVE AREAS.
- 3.4. WHEN WORK IS PERFORMED IN AND NEAR WATER COURSES, STREAM FLOW DIVERSION METHODS SHALL BE IMPLEMENTED PRIOR TO ANY EXCAVATION OR FILLING.
- 3.5. WHEN WORK IS PERFORMED WITHIN 50 FEET OF SURFACE WATERS (WETLAND, OPEN WATER OR FLOWING WATER), PERIMETER CONTROL SHALL BE ENHANCED CONSISTENT WITH SECTION 2.1.2.1. OF THE 2012 NPDES CONSTRUCTION GENERAL PERMIT.

### 4. MINIMIZE THE AMOUNT OF EXPOSED SOIL:

- 4.1. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS. MINIMIZE THE AREA OF EXPOSED SOIL AT ANY ONE TIME. PHASING SHALL BE USED TO REDUCE THE AMOUNT AND DURATION OF SOIL EXPOSED TO THE ELEMENTS AND VEHICLE TRACKING.
- 4.2. UTILIZE TEMPORARY MULCHING OR PROVIDE ALTERNATE TEMPORARY STABILIZATION ON EXPOSED SOILS IN ACCORDANCE WITH TABLE 1.
- 4.3. THE MAXIMUM AMOUNT OF DISTURBED EARTH SHALL NOT EXCEED A TOTAL OF 5 ACRES FROM MAY 1<sup>st</sup> THROUGH NOVEMBER 30<sup>th</sup>, OR EXCEED ONE ACRE DURING WINTER MONTHS, UNLESS THE CONTRACTOR DEMONSTRATES TO THE DEPARTMENT THAT THE ADDITIONAL AREA OF DISTURBANCE IS NECESSARY TO MEET THE CONTRACTORS CRITICAL PATH METHOD SCHEDULE (CPM), AND THE CONTRACTOR HAS ADEQUATE RESOURCES AVAILABLE TO ENSURE THAT ENVIRONMENTAL COMMITMENTS WILL BE MET.

### 5. CONTROL STORMWATER FLOWING ONTO AND THROUGH THE PROJECT:

- 5.1. DIVERT OFF SITE RUNOFF OR CLEAN WATER AWAY FROM THE CONSTRUCTION ACTIVITY TO REDUCE THE VOLUME THAT NEEDS TO BE TREATED ON SITE.
- 5.2. DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM DISTURBED AREAS, SLOPES, AND AROUND ACTIVE WORK AREAS AND TO A STABILIZED OUTLET LOCATION.
- 5.3. CONSTRUCT IMPERMEABLE BARRIERS AS NECESSARY TO COLLECT OR DIVERT CONCENTRATED FLOWS FROM WORK OR DISTURBED AREAS.
- 5.4. STABILIZE, TO APPROPRIATE ANTICIPATED VELOCITIES, CONVEYANCE CHANNELS OR PUMPING SYSTEMS NEEDED TO CONVEY CONSTRUCTION STORMWATER TO BASINS AND DISCHARGE LOCATIONS PRIOR TO USE.
- 5.5. DIVERT OFF-SITE WATER THROUGH THE PROJECT IN AN APPROPRIATE MANNER SO NOT TO DISTURB THE UPSTREAM OR DOWNSTREAM SOILS, VEGETATION OR HYDROLOGY BEYOND THE PERMITTED AREA.

### 6. PROTECT SLOPES:

- 6.1. INTERCEPT AND DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM UNPROTECTED AND NEWLY ESTABLISHED AREAS AND SLOPES TO A STABILIZED OUTLET OR CONVEYANCE.
- 6.2. CONSIDER HOW GROUNDWATER SEEPAGE ON CUT SLOPES MAY IMPACT SLOPE STABILITY AND INCORPORATE APPROPRIATE MEASURES TO MINIMIZE EROSION.
- 6.3. CONVEY STORMWATER DOWN THE SLOPE IN A STABILIZED CHANNEL OR SLOPE DRAIN.
- 6.4. THE OUTER FACE OF THE FILL SLOPE SHOULD BE IN A LOOSE RUFFLED CONDITION PRIOR TO TURF ESTABLISHMENT. TOPSOIL OR HUMUS LAYERS SHALL BE TRACKED UP AND DOWN THE SLOPE, DISKED, HARROWED, DRAGGED WITH A CHAIN OR MAT, MACHINE-RAKED, OR HAND-WORKED TO PRODUCE A RUFFLED SURFACE.

### 7. ESTABLISH STABILIZED CONSTRUCTION EXITS:

- 7.1. INSTALL AND MAINTAIN CONSTRUCTION EXITS, ANYWHERE TRAFFIC LEAVES A CONSTRUCTION SITE ONTO A PUBLIC RIGHT-OF-WAY.
- 7.2. SWEEP ALL CONSTRUCTION RELATED DEBRIS AND SOIL FROM THE ADJACENT PAVED ROADWAYS AS NECESSARY.

### 8. PROTECT STORM DRAIN INLETS:

- 8.1. DIVERT SEDIMENT LADEN WATER AWAY FROM INLET STRUCTURES TO THE EXTENT POSSIBLE.
- 8.2. INSTALL SEDIMENT BARRIERS AND SEDIMENT TRAPS AT INLETS TO PREVENT SEDIMENT FROM ENTERING THE DRAINAGE SYSTEM.
- 8.3. CLEAN CATCH BASINS, DRAINAGE PIPES, AND CULVERTS IF SIGNIFICANT SEDIMENT IS DEPOSITED.
- 8.4. DROP INLET SEDIMENT BARRIERS SHOULD NEVER BE USED AS THE PRIMARY MEANS OF SEDIMENT CONTROL AND SHOULD ONLY BE USED TO PROVIDE AN ADDITIONAL LEVEL OF PROTECTION TO STRUCTURES AND DOWN-GRADIENT SENSITIVE RECEPTORS.

### 9. SOIL STABILIZATION:

- 9.1. WITHIN THREE DAYS OF THE LAST ACTIVITY IN AN AREA, ALL EXPOSED SOIL AREAS, WHERE CONSTRUCTION ACTIVITIES ARE COMPLETE, SHALL BE STABILIZED.
- 9.2. IN ALL AREAS, TEMPORARY SOIL STABILIZATION MEASURES SHALL BE APPLIED IN ACCORDANCE WITH THE STABILIZATION REQUIREMENTS (SECTION 2.2) OF THE 2012 CGP. (SEE TABLE 1 FOR GUIDANCE ON THE SELECTION OF TEMPORARY SOIL STABILIZATION MEASURES.)
- 9.3. EROSION CONTROL SEED MIX SHALL BE SOWN IN ALL INACTIVE CONSTRUCTION AREAS THAT WILL NOT BE PERMANENTLY SEEDED WITHIN TWO WEEKS OF DISTURBANCE AND PRIOR TO SEPTEMBER 15, OF ANY GIVEN YEAR, IN ORDER TO ACHIEVE VEGETATIVE STABILIZATION PRIOR TO THE END OF THE GROWING SEASON.
- 9.4. SOIL TACKIFIERS MAY BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND REAPPLIED AS NECESSARY TO MINIMIZE SOIL AND MULCH LOSS UNTIL PERMANENT VEGETATION IS ESTABLISHED.

### 10. RETAIN SEDIMENT ON-SITE AND CONTROL DEWATERING PRACTICES:

- 10.1. TEMPORARY SEDIMENT BASINS (CGP-SECTION 2.1.3.2) OR SEDIMENT TRAPS (ENV-WO 1506.10) SHALL BE SIZED TO RETAIN, ON SITE, THE VOLUME OF A 2-YEAR 24-HOUR STORM EVENT FOR ANY AREA OF DISTURBANCE OR 3,600 CUBIC FEET OF STORMWATER RUNOFF PER ACRE OF DISTURBANCE, WHICHEVER IS GREATER. TEMPORARY SEDIMENT BASINS USED TO TREAT STORMWATER RUNOFF FROM AREAS GREATER THAN 5-ACRES OF DISTURBANCE SHALL BE SIZED TO ALSO CONTROL STORMWATER RUNOFF FROM A 10-YEAR 24 HOUR STORM EVENT. ON-SITE RETENTION OF THE 10-YEAR 24-HOUR EVENT IS NOT REQUIRED.
- 10.2. CONSTRUCT AND STABILIZE DEWATERING INFILTRATION BASINS PRIOR TO ANY EXCAVATION THAT MAY REQUIRE DEWATERING.
- 10.3. TEMPORARY SEDIMENT BASINS OR TRAPS SHALL BE PLACED AND STABILIZED AT LOCATIONS WHERE CONCENTRATED FLOW (CHANNELS AND PIPES) DISCHARGE TO THE SURROUNDING ENVIRONMENT FROM AREAS OF UNSTABILIZED EARTH DISTURBING ACTIVITIES.

## 11. ADDITIONAL EROSION AND SEDIMENT CONTROL GENERAL PRACTICES:

- 11.1. USE TEMPORARY MULCHING, PERMANENT MULCHING, TEMPORARY VEGETATIVE COVER, AND PERMANENT VEGETATIVE COVER TO REDUCE THE NEED FOR DUST CONTROL. USE MECHANICAL SWEEPERS ON PAVED SURFACES WHERE NECESSARY TO PREVENT DUST BUILDUP. APPLY WATER, OR OTHER DUST INHIBITING AGENTS OR TACKIFIERS, AS APPROVED BY THE NHDES.
- 11.2. ALL STOCKPILES SHALL BE CONTAINED WITH TEMPORARY PERIMETER CONTROLS. INACTIVE SOIL STOCKPILES SHOULD BE PROTECTED WITH SOIL STABILIZATION MEASURES (TEMPORARY EROSION CONTROL SEED MIX AND MULCH, SOIL BINDER) OR COVERED WITH ANCHORED TARPS.
- 11.3. EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED IN ACCORDANCE WITH SECTION 645 OF NHDOT SPECIFICATIONS, WEEKLY AND WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.25 IN. OF RAIN PER 24-HOUR PERIOD. EROSION AND SEDIMENT CONTROL MEASURES WILL ALSO BE INSPECTED IN ACCORDANCE WITH THE GUIDANCE MEMO FROM THE NHDES CONTAINED WITHIN THE CONTRACT PROPOSAL AND THE EPA CONSTRUCTION GENERAL PERMIT.
- 11.4. THE CONTRACTOR SHOULD UTILIZE STORM DRAIN INLET PROTECTION TO PREVENT SEDIMENT FROM ENTERING A STORM DRAINAGE SYSTEM PRIOR TO THE PERMANENT STABILIZATION OF THE CONTRIBUTING DISTURBED AREA.
- 11.5. PERMANENT STABILIZATION MEASURES WILL BE CONSTRUCTED AND MAINTAINED IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS TO STABILIZE AREAS. VEGETATIVE STABILIZATION SHALL NOT BE CONSIDERED PERMANENTLY STABILIZED UNTIL VEGETATIVE GROWTH COVERS AT LEAST 85% OF THE DISTURBED AREA. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL FOR ONE YEAR AFTER PROJECT COMPLETION.
- 11.6. CATCH BASINS: CARE SHALL BE TAKEN TO ENSURE THAT SEDIMENTS DO NOT ENTER ANY EXISTING CATCH BASINS DURING CONSTRUCTION. THE CONTRACTOR SHALL PLACE TEMPORARY STONE INLET PROTECTION OVER INLETS IN AREAS OF SOIL DISTURBANCE THAT ARE SUBJECT TO SEDIMENT CONTAMINATION.
- 11.7. TEMPORARY AND PERMANENT DITCHES SHALL BE CONSTRUCTED, STABILIZED AND MAINTAINED IN A MANNER THAT WILL MINIMIZE SCOUR. TEMPORARY AND PERMANENT DITCHES SHALL BE DIRECTED TO DRAIN TO SEDIMENT BASINS OR STORM WATER COLLECTION AREAS.
- 11.8. WINTER EXCAVATION AND EARTHWORK ACTIVITIES NEED TO BE LIMITED IN EXTENT AND DURATION, TO MINIMIZE POTENTIAL EROSION AND SEDIMENTATION IMPACTS. THE AREA OF EXPOSED SOIL SHALL BE LIMITED TO ONE ACRE, OR THAT WHICH CAN BE STABILIZED AT THE END OF EACH DAY UNLESS A WINTER CONSTRUCTION PLAN, DEVELOPED BY A QUALIFIED ENGINEER OR A CPSC SPECIALIST, IS REVIEWED AND APPROVED BY THE DEPARTMENT.
- 11.9. CHANNEL PROTECTION MEASURES SHALL BE SUPPLEMENTED WITH PERIMETER CONTROL MEASURES WHEN THE DITCH LINES OCCUR AT THE BOTTOM OF LONG FILL SLOPES. THE PERIMETER CONTROLS SHALL BE INSTALLED ON THE FILL SLOPE TO MINIMIZE THE POTENTIAL FOR FILL SLOPE SEDIMENT DEPOSITS IN THE DITCH LINE.

## BEST MANAGEMENT PRACTICES (BMP) BASED ON AMOUNT OF OPEN CONSTRUCTION AREA

### 12. STRATEGIES SPECIFIC TO OPEN AREAS LESS THAN 5 ACRES:

- 12.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17 AND ENV-WO 1500: ALTERATION OF TERRAIN FOR CONSTRUCTION AND USE ALL CONVENTIONAL BMP STRATEGIES.
- 12.2. SLOPES STEEPER THAN 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING.
- 12.3. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT ALONE.
- 12.4. AREAS WHERE HAUL ROADS ARE CONSTRUCTED AND STORMWATER CANNOT BE TREATED THE DEPARTMENT WILL CONSIDER INFILTRATION.
- 12.5. FOR HAUL ROADS ADJACENT TO SENSITIVE ENVIRONMENTAL AREAS OR STEEPER THAN 5%, THE DEPARTMENT WILL CONSIDER USING EROSION STONE, CRUSHED GRAVEL, OR CRUSHED STONE BASE TO HELP MINIMIZE EROSION ISSUES.
- 12.6. ALL AREAS THAT CAN BE STABILIZED SHALL BE STABILIZED PRIOR TO OPENING UP NEW TERRITORY.
- 12.7. DETENTION BASINS SHALL BE DESIGNED AND CONSTRUCTED TO ACCOMMODATE A 2 YEAR STORM EVENT.

### 13. STRATEGIES SPECIFIC TO OPEN AREAS BETWEEN 5 AND 10 ACRES:

- 13.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17 AND ENV-WO 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES WILL BE UTILIZED.
- 13.2. DETENTION BASINS WILL BE CONSTRUCTED TO ACCOMMODATE THE 2-YEAR 24-HOUR STORM EVENT AND CONTROL A 10-YEAR 24-HOUR STORM EVENT.
- 13.3. SLOPES STEEPER THAN A 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS. OTHER ALTERNATIVE MEASURES, SUCH AS BONDED FIBER MATRICES (BFMS) OR FLEXIBLE GROWTH MEDIUMS (FGMS) MAY BE UTILIZED, IF MEETING THE NHDES APPROVALS AND REGULATIONS.
- 13.4. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS.

### 14. STRATEGIES SPECIFIC TO OPEN AREAS OVER 10 ACRES:

- 14.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17 AND ENV-WO 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES AND BETWEEN 5 AND 10 ACRES WILL BE UTILIZED.
- 14.2. THE DEPARTMENT ANTICIPATES THAT SOIL BINDERS WILL BE NEEDED ON ALL SLOPES STEEPER THAN 3:1, IN ORDER TO MINIMIZE EROSION AND REDUCE THE AMOUNT OF SEDIMENT IN THE STORMWATER TREATMENT BASINS.
- 14.3. THE CONTRACTOR WILL BE REQUIRED TO HAVE AN APPROVED DESIGN IN ACCORDANCE WITH ENV-WO 1506.12 FOR AN ACTIVE FLOCCULANT TREATMENT SYSTEM TO TREAT AND RELEASE WATER CAPTURED IN STORM WATER BASINS. THE CONTRACTOR SHALL ALSO RETAIN THE SERVICES OF AN ENVIRONMENTAL CONSULTANT WHO HAS DEMONSTRATED EXPERIENCE IN THE DESIGN OF FLOCCULANT TREATMENT SYSTEMS. THE CONSULTANT WILL ALSO BE RESPONSIBLE FOR THE IMPLEMENTATION AND MONITORING OF THE SYSTEM.

TABLE 1  
GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES

APPLICATION AREAS	DRY MULCH METHODS				HYDRAULICALLY APPLIED MULCHES <sup>2</sup>				ROLLED EROSION CONTROL BLANKETS <sup>3</sup>			
	HMT	WC	SG	CB	HM	SMM	BFM	FRM	SNSB	DNSB	DNSCB	DNCS
SLOPES <sup>1</sup>												
STEEPER THAN 2:1	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES
2:1 SLOPE	YES <sup>1</sup>	YES <sup>1</sup>	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES
3:1 SLOPE	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
4:1 SLOPE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
WINTER STABILIZATION	4T/AC	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
CHANNELS												
LOW FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
HIGH FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE
HMT	HAY MULCH & TACK	HM	HYDRAULIC MULCH	SNSB	SINGLE NET STRAW BLANKET
WC	WOOD CHIPS	SMM	STABILIZED MULCH MATRIX	DNSB	DOUBLE NET STRAW BLANKET
SG	STUMP GRINDINGS	BFM	BONDED FIBER MATRIX	DNSCB	2 NET STRAW-COCONUT BLANKET
CB	COMPOST BLANKET	FRM	FIBER REINFORCED MEDIUM	DNCS	2 NET COCONUT BLANKET

#### NOTES:

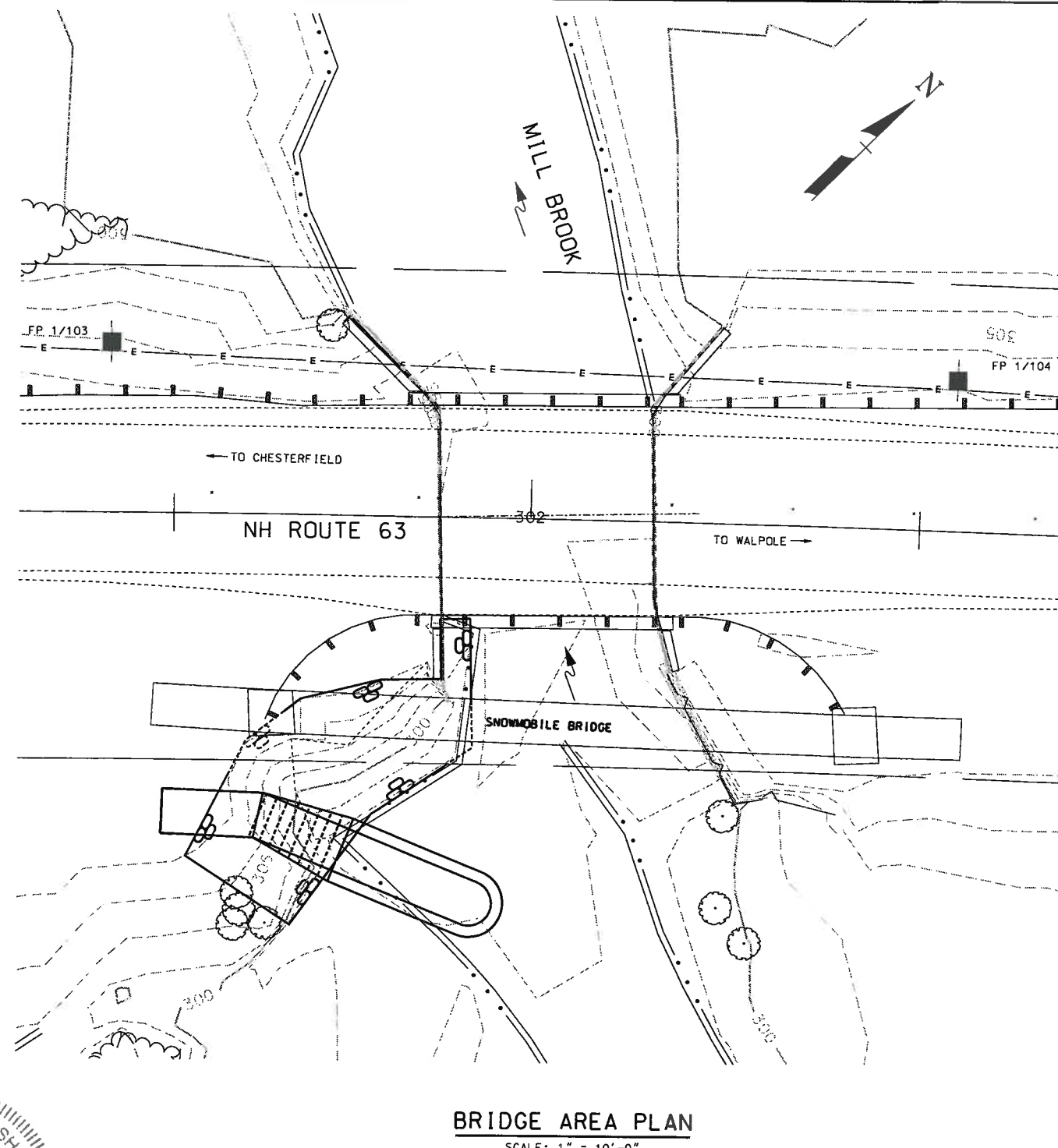
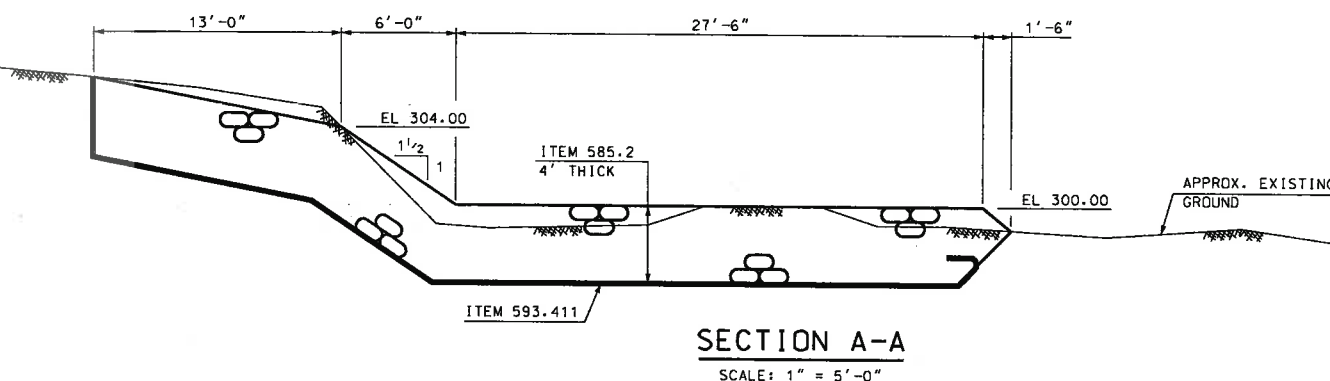
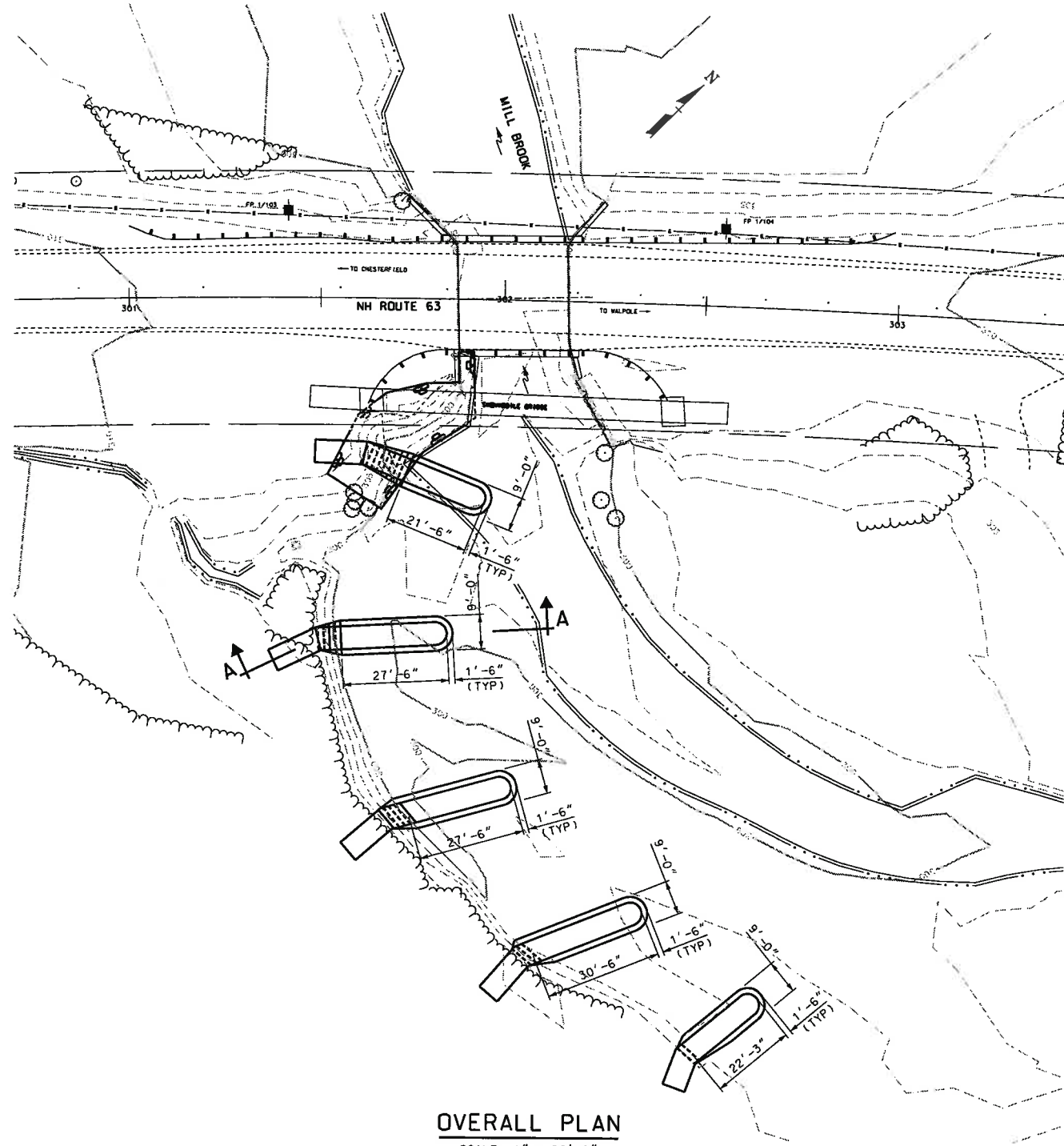
1. ALL SLOPE STABILIZATION OPTIONS ASSUME A SLOPE LENGTH  $\leq 10$  TIMES THE HORIZONTAL DISTANCE COMPONENT OF THE SLOPE, IN FEET.
2. PRODUCTS CONTAINING POLYACRYLAMIDE (PAM) SHALL NOT BE APPLIED DIRECTLY TO OR WITHIN 100 FEET OF ANY SURFACE WATER WITHOUT PRIOR WRITTEN APPROVAL FROM THE NH DEPARTMENT OF ENVIRONMENTAL SERVICES.
3. ALL EROSION CONTROL BLANKETS SHALL BE MADE WITH WILDLIFE FRIENDLY BIODEGRADABLE NETTING.

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

## WETLAND IMPACT PLANS

REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
12-21-2015	erosstrat	27287	5	7

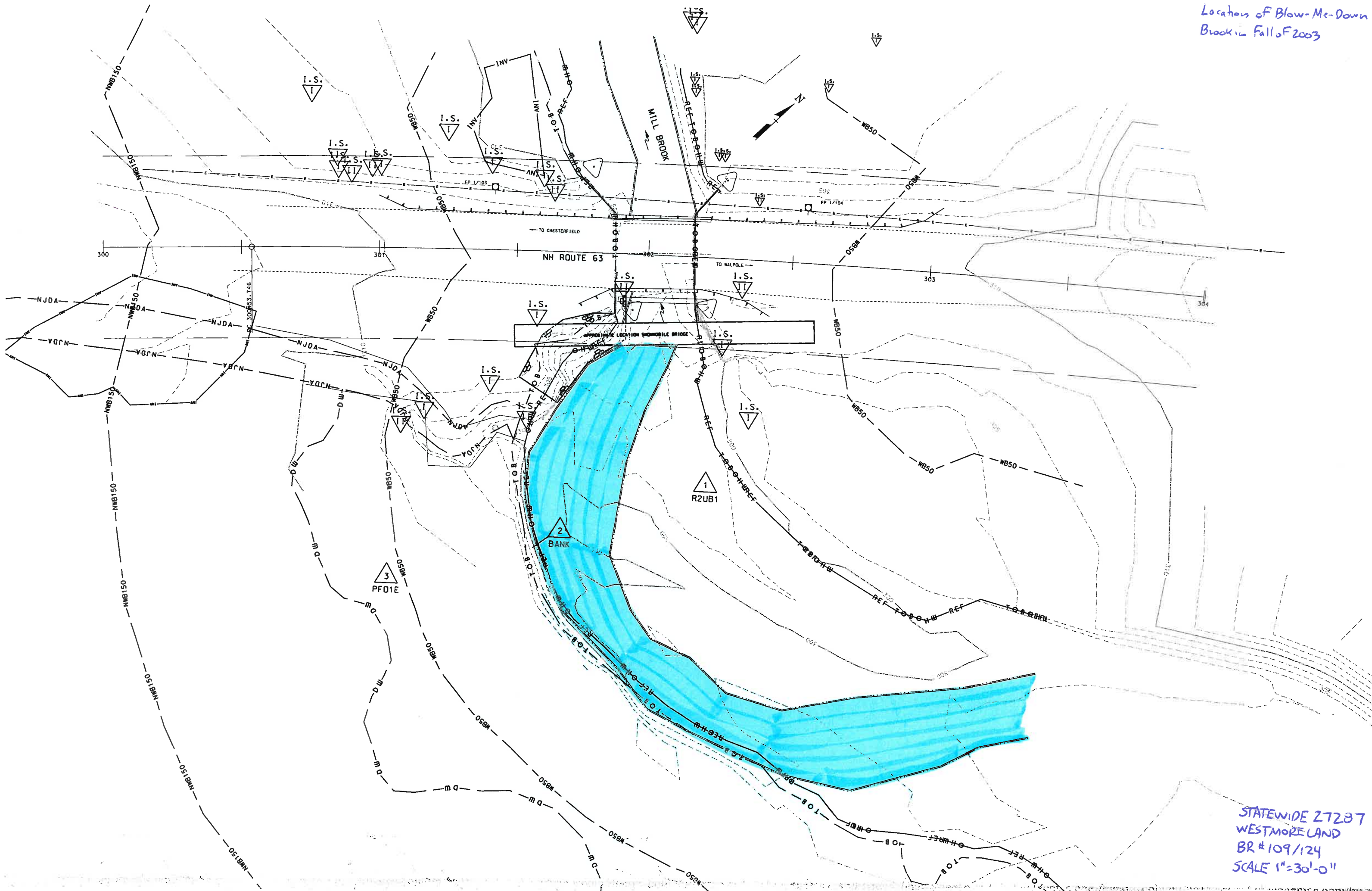


STATE OF NEW HAMPSHIRE  
JASON A. TREMBLAY  
No. 10802  
LICENSED PROFESSIONAL ENGINEER  
07-13-17

STATE OF NEW HAMPSHIRE																	
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN																	
TOWN		WESTMORELAND		BRIDGE NO.		109/124		STATE PROJECT		27287							
LOCATION		NH RTE 63 over MILL BROOK															
WESTMORELAND BR NO 109/124										BRIDGE SHEET							
REVISIONS AFTER PROPOSAL				BY		DATE		BY		DATE		XX OF					
				DESIGNED		JAT		12/16		CHECKED			XXX		XX/XX		FILE NUMBER
				DRAWN		SMG		12/16		CHECKED			XXX		XX/XX		
				QUANTITIES		XXX		XX/XX		CHECKED			XXX		XX/XX		
				ISSUE DATE				FEDERAL PROJECT NO.					SHEET NO.		TOTAL SHEETS		
				REV. DATE						7		7					

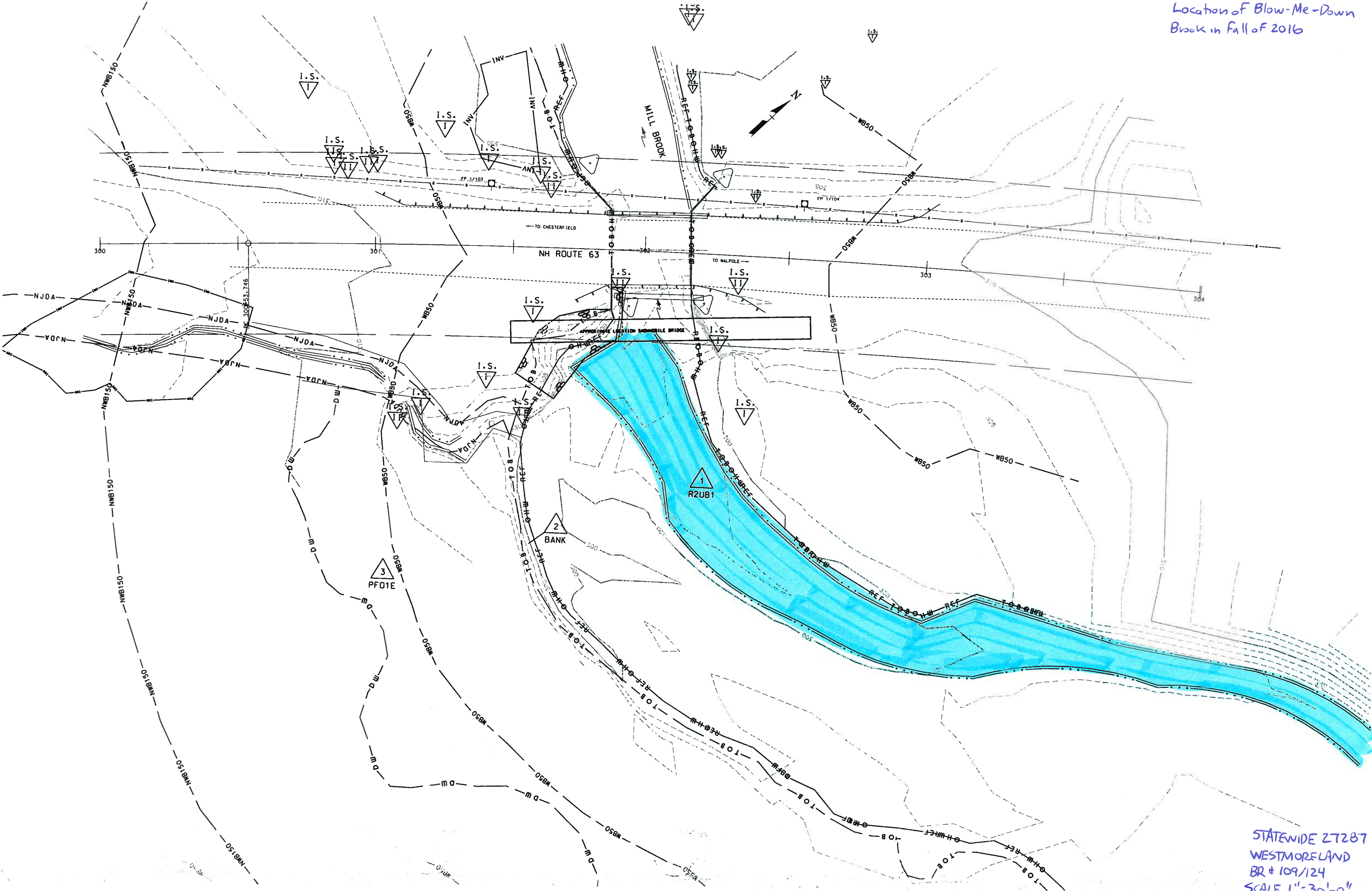
SUBDIRECTORY	DGN LOCATOR	SHEET SCALE
BR/CONTRACT #1	109-124 Genplan	AS NOTED

Locations of Blow-Me-Down  
Brook in Fall of 2003

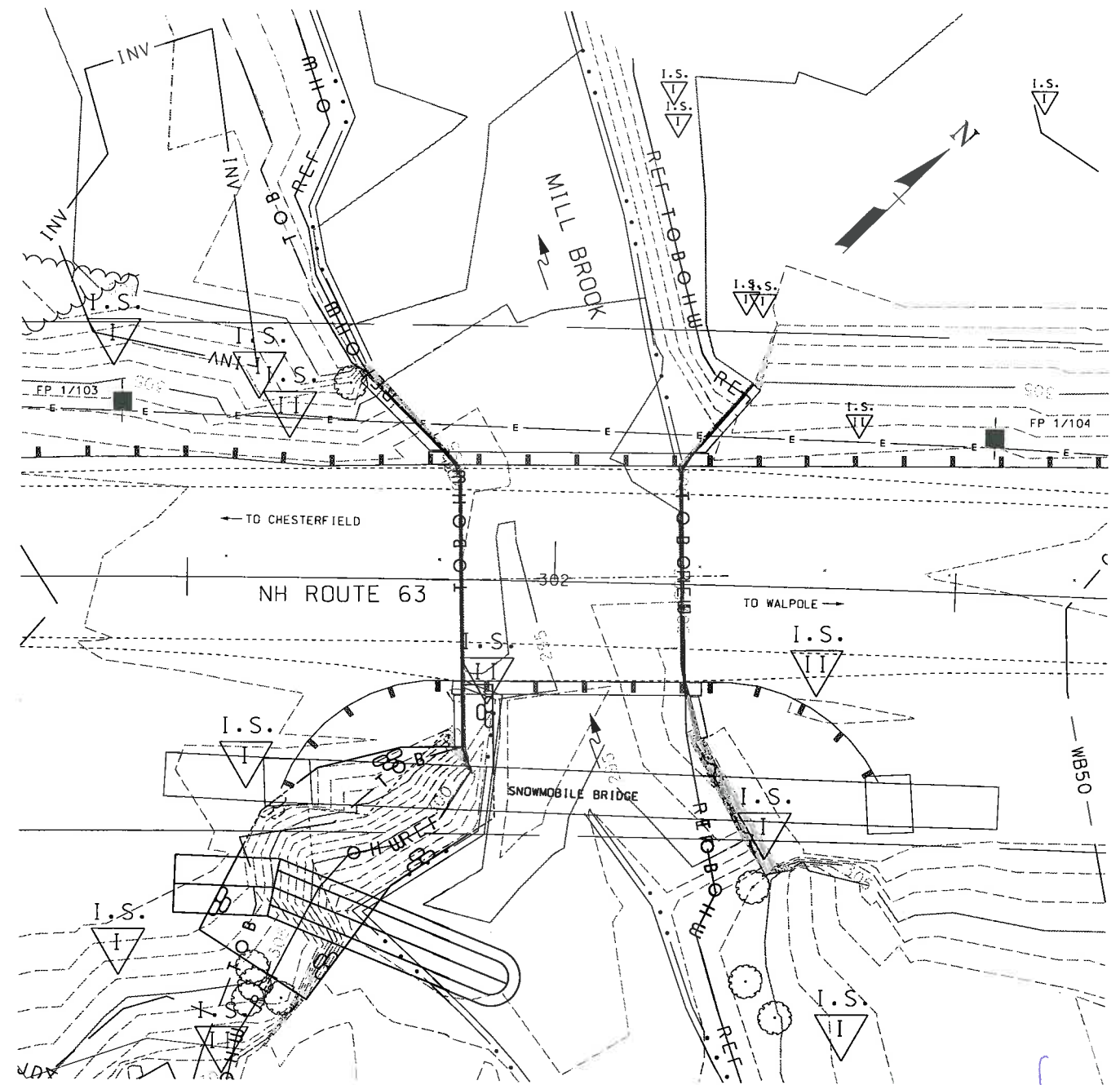
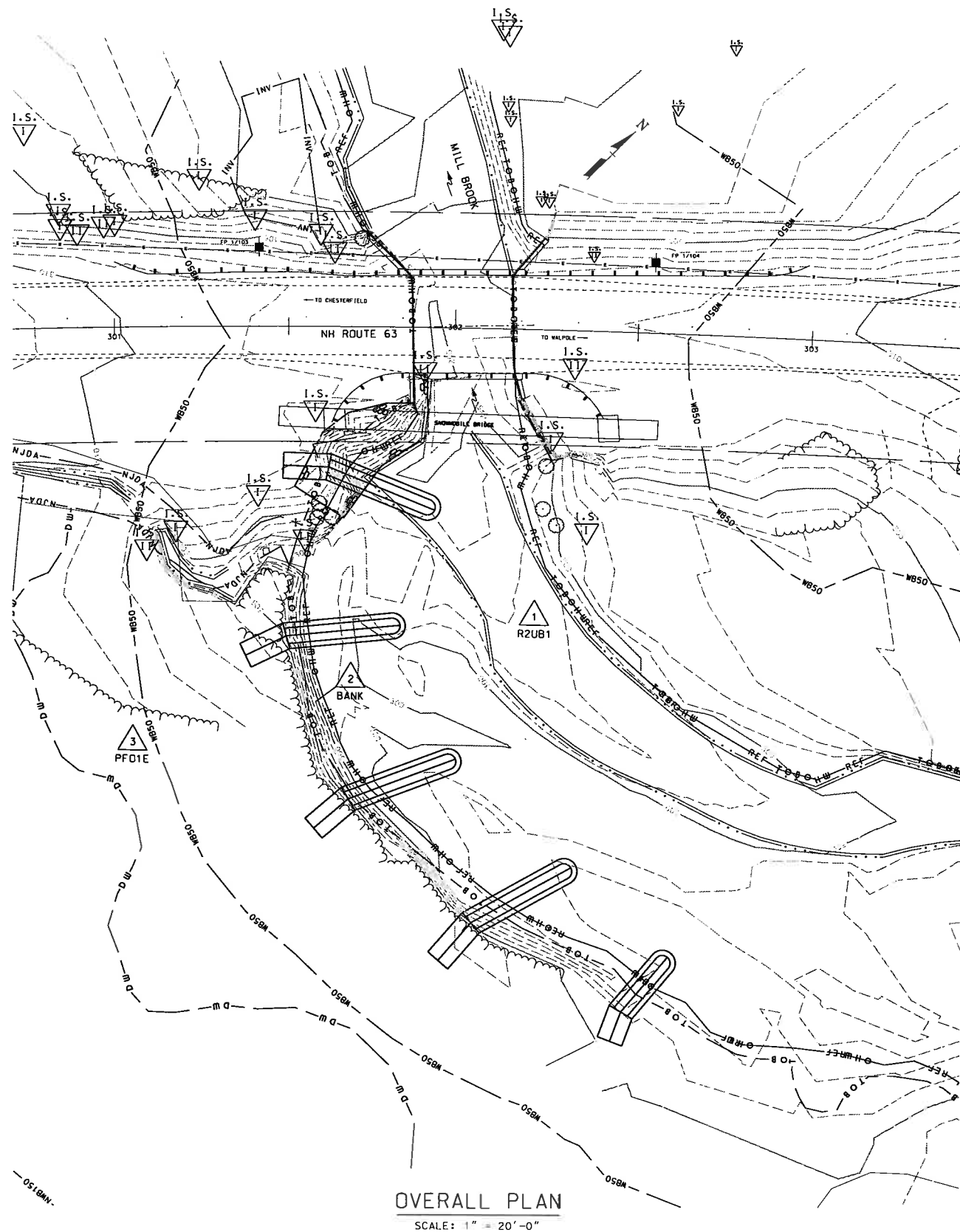


STATEWIDE 27287  
WESTMORELAND  
BR #109/124  
SCALE 1"=30'-0"

Location of Blow-Me-Down  
Brook in Fall of 2016



STATEWIDE 27287  
WESTMORELAND  
BR # 109/124  
SCALE 1"=30'-0"



STATE OF NEW HAMPSHIRE										
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN										
TOWN	WESTMORELAND			BRIDGE NO.	109/124		STATE PROJECT	27287		
LOCATION	NH RTE 63 over MILL BROOK									
WESTMORELAND BR NO 109/124								BRIDGE SHEET		
REVISIONS AFTER PROPOSAL			BY		DATE		BY		DATE	
			DESIGNED	JAT	12/16	CHECKED	XXX	XX/XX	XX OF	
			DRAWN	SMG	12/16	CHECKED	XXX	XX/XX	FILE NUMBER	
			QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX		
			ISSUE DATE	FEDERAL PROJECT NO.			SHEET NO.			TOTAL SHEETS
			REV. DATE	-----			1			1

SUBDIRECTORY	DGN LOCATOR	SHEET SCALE
BRC/CONTRACT #1	109-124 Genplan	AS NOTED